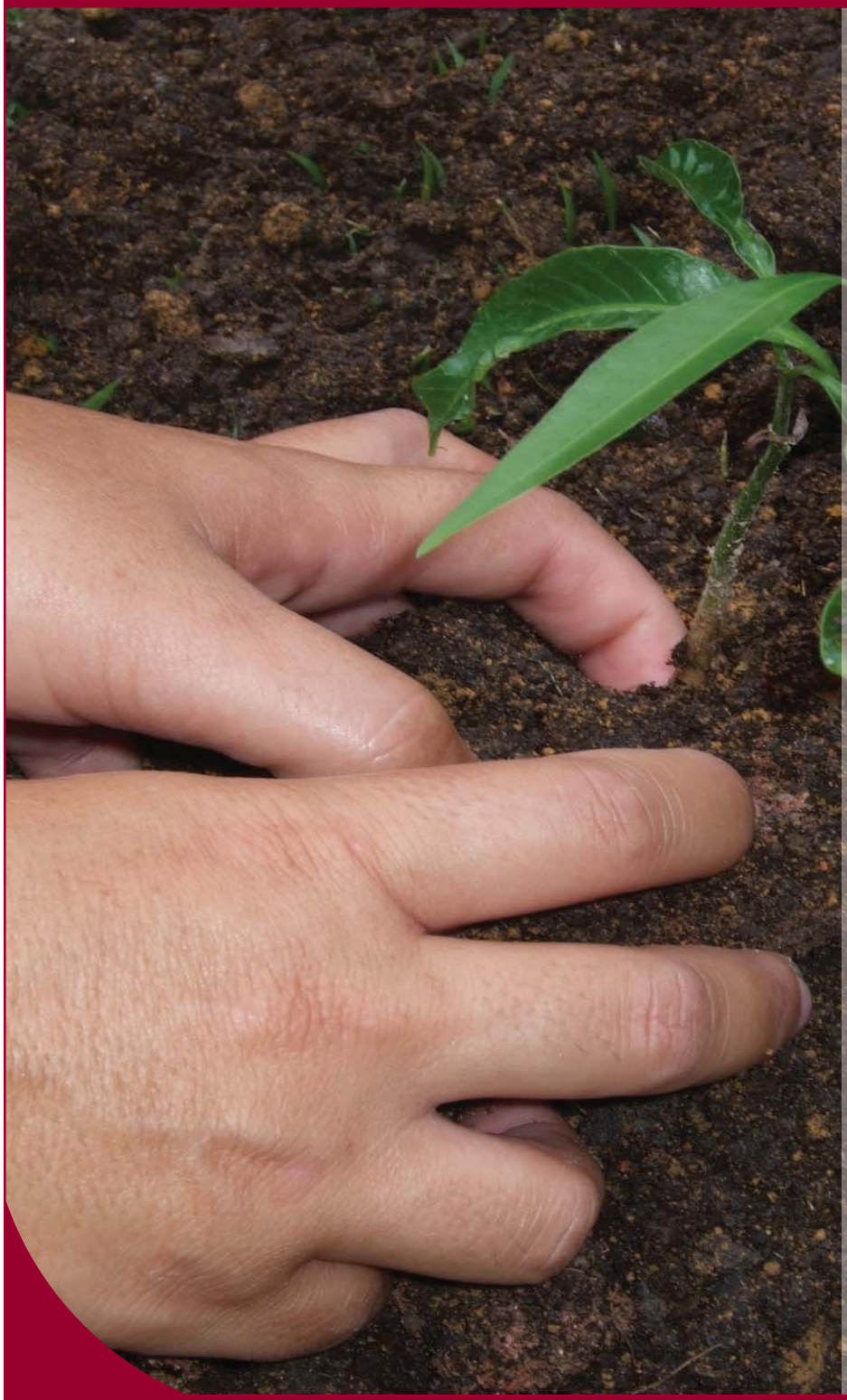
Soil Science Instrumentation



Delta-T Devices | Eijkelkamp Agrisearch Equipment | UMS measure to know | HOSKIN SCIENTIFIC | SOILMOISTURE | DECAGON DEVICES | ADC BioScientific Ltd.

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Auger Sets

Part Number	Description
01.11.SE Ergonomical auger set	This set for heterogeneous soils is used to carry out manual drilling and sampling in a great variety of different soils in an ergonomically sound way. It is particularly suitable for general soil investigation (description of the layering, geology, archeaology) as well as taking samples for such activities as environmental research.
01.11.SO Auger set for heterogeneous soils	Augerings and samplings in homogeneous soils, in almost all cases can be executed with one type of auger. For augerings in heterogeneous soils, several different auger types will be applied. This led to an auger set for heterogeneous soils. With the standard set it is possible to execute manual augering to a depth of 5 meter, without great physical effort
01.11.SZ Auger set for heterogeneous soils	This auger set for heterogeneous soils is the same as the one mentioned above, but with a conical screw thread connection.
01.16 Prospecting kit for geological surveys	The kit can be used for augerings in heterogeneous soils, to improve the mobility it comprises less different auger types.
01.09.SA Piston Sampler set 01.09.SB Dividable piston sampler set	The sets are very suitable for sampling less cohesive soil layers below the (ground) water table to a depth up to 5 meter. The samples show little disturbance and therefore are suitable for very accurate profile description. With 01.09.SA set one piston sampler is used with a sample gutter to empty the sampler in. The 01.09.SB set with dividable piston sampler enables you to take samples of various lengths with sample tubes with 50, 100 and 150 cm length.

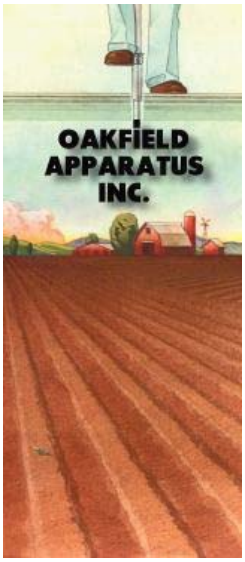
Individual Augers

Various auger types:

- Edelman augers
- Riverside auger
- Stony soil auger
- Spiral auger
- Stone catcher
- Soft soil auger
- Gouge auger
- Piston sampler

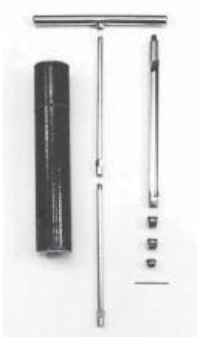
Hand auger equipment is extremely suitable for soil research. As almost any type of soil sets its own demands where it concerns the model of the auger to be applied. In the course of the years many models have been developed. Years of experience and many contacts with soil researchers at home and abroad made it possible to achieve the optimum design for various types.

8-10 meter
By applying extension rods with a bayonet- or a conical threaded connection augering to greater depths is possible. With hand auger equipment a depth of 8-10 meter can realistically be achieved. The maximum boring depth strongly depends on various factors such as: depth of the groundwater, the soil profile, the characteristics of the material the auger has to pass through.



MODEL DB

39" Tube Kit with 3 tips contains:
- 1 - 12" Handle
- 2 - 12" Extension rods
- 1 - 15" Tube
- 1 ea. S-1, S-2 and S-3 tip
- 1 - #10 Tip wrench
- 1 - 17" Heavy fiberboard case



MODEL L & LS

MODEL L: 36" one-piece welded unit with a replaceable screw-on tip. Please specify tip when inquiring.
MODEL LS: Same as MODEL L but has added feature of a footstep (right).

SOIL TUBES

1 #102 12" Soil Tube with screw on tip
2 #115 15" Soil Tube with screw on tip
3 #103 18" Soil Tube with screw on tip
4 #815HD 15" Heavy Duty Soil Tube with screw on tip

For use in peat or peat-like soil.

SCREW ON TIPS

S-1 Dry Tip
S-2 Regular Tip
S-3 Wet Tip
S-4 Heavy Duty Tip
#10 Tip Wrench

(The above tips can be ordered separately.)

Peat and Root Samplers

Various Sampler Types:

- Flag/Russian Peat Sampler, Standard Set
- Peat Profile Sampler - Wardenaar Type
- Vrijwit Auger
- Single Root Auger
- Surface Profile Sampler

Root research is executed to improve the insight in the possi for root growth (depth and concentration) of the root system of trees and plants.
In general it is important to all plants to have a dense and extensive root system in the soil. An extensive root system allows the plant to benefit from a large volume of soil. If sufficient quantities of nutrients and water are present the absorption larger if the root system is more extensive. Measuring the root system also is a useful means of localizing physical and/or chemical barriers in the soil profile.

Soil Core Samplers

Samplers:

- Single Gouge Auger Set
- Single Gouge Auger Set, Purckhauer
- Two-Piece Gouge Auger
- Split-Tube Soil Sampling Kit
- Soil Coring Kit for Chemical Research
- Liner Sampler for Sampling in Soft or Hard Soils
- Soil Sample Ring Kit
- Soil Column Cylinder Sampler
- Percussion Drilling Set for Heterogeneous Soils

Hand-operated equipment can be applied for soil research up to a depth of 5 to 10 meter. The mutual quality of many gouge augers is that they all are fitted with an almost half-cylindrical operational part with parallel cutting edges running vertically, justifying the name gouge auger. This operational part may vary in length as well as in diameter. The most suitable length depends on the penetration resistance, the substance of the soil and the required boring depth. The longer the operational part the more vulnerable the auger is to torsion. The selection of the most suitable diameter depends on the composition and the structure of the soil and on the purpose of the research.

In general a smaller diameter is applied in soils with a fine and/or dense structure, by comparison to soils with a loose structure (for instance young swampy peat).

Munsell Soil Charts Convenient waterproof binder and washable pages make this book ideal for taking in the field... you can even use it in the rain!

Classify soil under a broad range of environmental conditions.
We worked closely with U.S. Soil Conservation Service to provide the colors that help you most accurately classify soils. And since color is an indicator of chemical, physical and biological changes, we designed the book to included broadest range of environmental conditions.

Works with other natural specimens too!
You can also use the charts for classifying rocks, archaeological specimens, animal pelage and other natural specimens that fall within this color range.

Everything you need in one convenient package.
You'll have everything you need to easily conduct on-the-spot analyses. We've included easy-view masks and apertures between color chips; **plus** illustrations of soil grain structures and charts for estimating proportions of mottles and coarse fragments.

Features:

• 7 hue-based color charts including (10R, 2.5YR, 5YR, 7.5YR,
10YR, 2.5Y, and 5Y)
• 2 Gley charts (blue and green colors, and grey scale for submerged soils)
•Over 322 matte color chips, permanently mounted
•Soil grain illustrations
•Charts for estimating proportions of mottles and coarse fragments
•Convenient tabbed pages
•Waterproof washable pages
•Rite-In-Rain® notes page.
•Easy view black and grey masks
•Easy view apertures between color chips
•Vinyl protective binder

A must-have for anyone working with soil!

Soil Gas Lance

Features:

Features:
The soil gas lance is suitable for extracting soil gas in unsaturated soils.
The semipermeable hydrophobic membrane is permeable only for gas, but not for solution.
The membrane is hydrophobic, and therefore cannot pick up moisture.
The bubble point is near 80 kPa.

Technical Data:

Diameter: 8 mm
Total length: 200 mm
Porous length of membrane: 100 mm
Capillary tube: outer diameter 1/8"; inner diameter 1/16"
Material membrane: PTFE (Teflon)
Material tube/s and parts: Stainless steel
Connector: Swagelock 1/8"

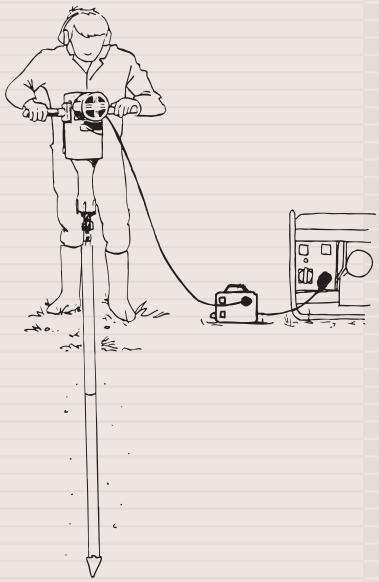
Configurations

Art. No.	Description
BGL-200	The Soil gas lance (single capillary tube) has one capillary tube. On this a vacuum is applied to suck up the soil gas. The capillary tube is connected for example to an evacuated sampling bottle with septum and a cannula, or to a gas sampling bottle evacuated by an external vacuum pump.
BGLD-200	The Soil gas lance (dual capillary tubes) has two capillary tubes. The air inside the sampler moves along the inside of the membrane and equalizes to the soil gas by diffusion through the membrane, then is pulled out of one tube, lead through a gas analyser and back into the sampler through the other tube. There is a tube inside the sampler so air enters at the upper end and is pulled out at the bottom end, so it travels along the full length of the membrane. So this is a constant circulation for online monitoring with a gas chromatography detector.

LOST CONE DRILLING METHOD

P1.10

Using an electrical percussion hammer and the casing the lost cone is hammered into the soil.



A filter tube is placed in the casing.

Drilling a bore hole is often combined with sampling and describing a profile.
If both these activities are not necessary during the drilling procedure then drilling can be executed fast and efficient applying the so called lost cone drilling method.

Eijkelkamp Agrisearch Equipment developed a manually controlled set using an electrical percussion hammer to hammer the lost cone and the accompanying casing into the soil.

10.100 Lost cone drilling set, standard set for drilling according to the lost cone method

The specially designed lost cone is hammered into the soil using an electrical percussion hammer which is placed on the casing.

The lost cone produces a very straight bore hole that is slightly wider in diameter than the casing in order to reduce the friction.

This procedure makes it easier to reach greater depth and the friction on extracting the casing is limited.

On reaching the desired depth a filter tube can be lowered through the casing or sensors can be left in the bore hole.

Subsequently the casing can be extracted using the 2-person operated rod puller in combination with the universal casing and rod pulling clamp.

This very complete set contains:
an electrical percussion hammer, an aggregate with insulation guard, striking pens, drive-cone holder for percussion casing, steel casing, pulling equipment, lost cones and various accessories.

The standard set is equipped for drilling to a depth of up to 10 m.

Lost cone drilling set

Lost cones

Casing with lost cone

LOST CONE DRILLING METHOD

P1.10

Applications

The lost cone drilling method is successfully applied when placing monitoring well pipes with a small diameter, for environmental research.

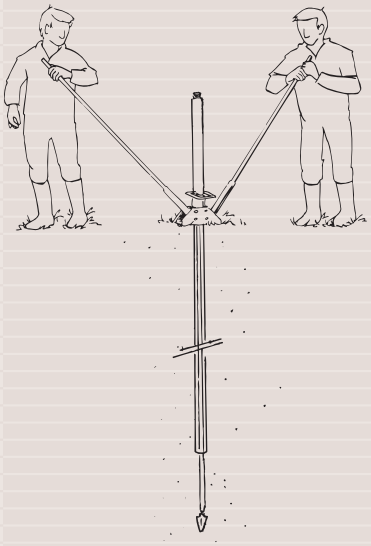
After drilling the lost cone is left in the soil. This does not cause any environmental problems as the material used is present in the soil by nature.

A completely different application of the set is making holes for the installation of explosives for seismic research.

Advantages

- Complete set.
- Fast and efficient drilling method.
- No large means of transport required allowing operation in less accessible areas.
- The special shape of the lost cones makes that there is less friction when the casing is inserted and extracted again.

Using the 2-man operated mechanical rod puller the casing is pulled from the bore hole.



Casing with striking pen

2-man operated mechanical rod puller

Casing/rod puller clamp + clamping jaw

BENEFITS

Lost cone drilling set

- Solves problems installing wells in stony soils
- Also the safest way to lower explosives
- Bentonite plugs will repair layers perfectly
- Ideal in combination with Direct Well
- Tested for ten-thousands of drilling meters
- Non-toxic iron lost point copes with analysis

Eijkelkamp Agrisearch Equipment

HOSKIN SCIENTIFIC

ACE

Automated Soil CO_2 Exchange System

Soil flux: an important component of total carbon budget

Rapidly rising atmospheric CO_2 concentration and its potential impact on future climatic conditions is an issue of increasing global economic and political significance.

Soil respiration can be defined as the net CO_2 production of a soil. The amount of gas exchange taking place is frequently used as an indicator of microbial soil activity and so is used to characterise the "health" of that soil. The rate of soil flux is influenced by a variety of environmental parameters especially organic matter content, soil moisture and soil temperature.

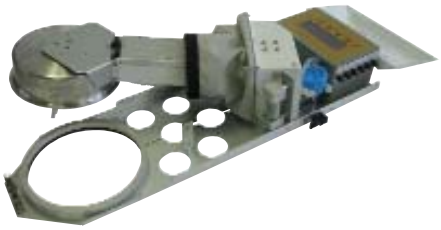
Natural biomass respiration from soil is a major carbon source. Understanding soil flux and its relationship with other sources and sinks within the carbon cycle are currently subject to increasing scientific scrutiny in relation to global climatic change.

The ADC BioScientific ACE system (Automated Soil CO_2 Exchange System) is designed for the long-term, unattended monitoring of soil flux for both temporal and spatial studies. Individual ACE Stations can be used independently or as part of an ACE Network of multiple ACE Stations.

- **Automated operation**
  Automatically exposes soil area between measurements

- **CO_2 analyser in chamber**
  Highly accurate CO_2 IRGA housed directly inside soil chamber assembly

- **Compact complete system**
  Fully integrated, independent measurement Station



- **Network**
  Up to 30 ACE Stations may be connected together in an ACE experimental network

ADC BioScientific Ltd

ADC BioScientific is one of the world's leading developers of high quality, field portable and easy to use gas exchange instrumentation for a variety of geoscience research applications.

For over 30 years ADC's name has been synonymous with soil respiration research, with an outstanding reputation for both laboratory and field based instrumentation.

Today, in hundreds of research institutes throughout the world, ADC gas exchange instrumentation is playing a vital role in improving our understanding of the carbon cycle and its impact on life on earth.

The ACE Automated Soil CO_2 Exchange System offers soil researchers many performance advantages compared to other available techniques and provides true value for money.

ADC BioScientific Ltd.

Technical Specification

ACE Station

Measurement of CO_2	Standard range nominally 40.0 mmols m^{-3} (0-896ppm at standard temperature and pressure) 0.05mmols m^{-3} resolution (1ppm). Infrared gas analyser housed directly adjacent to soil chamber. Differential open or closed system.
Measurement of PAR:	0-3000µmols m^{-2} sec^{-1}. Silicon photocell.
Measurement of soil temperature:	6 selectable inputs for thermistors.
Measurement of soil moisture:	4 selectable inputs for commercially available sensors.
Flow control to chamber:	200ml – 5L min^{-1}. (200-3700µmols^{-1}).
Flow control accuracy:	+/- 3% of f.s.d.
Display:	240 x 64 dot matrix LCD.
Programming:	Each ACE Station has a user-friendly interface driven by only 5 keys.
Recorded data:	Removeable Compact Flash cards
Internal battery:	12V standby 1.0Ah battery back up (Networked Station only).
Power supply:	External source battery, solar panel or wind turbine. One 40Ah car battery provides power for approximately 28 days of continuous use.
RS232 output:	User selectable rates of up to 19200 baud.
Electrical connections:	Robust, waterproof 3 pin and 5 pin RS232.
Dimensions:	82 x 33 x 13 cm
Closed chamber volume:	2.6L
Open chamber volume:	1.0L
Soil collar diameter:	23cm
ACE Station weight:	9.0kg

ACE Master control unit

Construction:	Steel sealed enclosure.
Electrical connections:	30 ACE Station docking ports.
Display:	Graphic 240 x 64 dot matrix LCD.
Programming:	User-friendly interface driven by only 5 keys.
Recorded data:	Dual Compact Flash card drive.
RS232 output:	User selectable rates of up to 19200 baud.
Power connection:	100 – 240 VAC Dual 12V battery docking ports.
Dimensions:	40 x 40 x 20 cm
Master Control Unit weight:	12.0kg

HOSKIN SCIENTIFIC

GMP343 Carbon Dioxide Probe for Demanding Measurements

The GMP343 is available as an open path, diffusion aspirated model (left) and as a flow-through model (right).

Features/Benefits

- Excellent accuracy and stability
- Vaisala CARBOCAP® Sensor, a silicon-based non-dispersive infrared (NDIR) sensor
- A single-beam, dual-wavelength CO_2 measurement with no moving parts
- Compensation options for temperature, pressure, humidity and oxygen
- Low power consumption and heat emission
- Designed for outdoor use
- Compact and lightweight

The Vaisala CARBOCAP® Carbon Dioxide Probe GMP343 is an accurate and rugged probe-type instrument for ecological measurements. Typical applications include:

- CO_2 soil respiration
- Ambient CO_2 monitoring
- Plant growth chambers
- OEM applications

Open path, diffusion aspirated probe

The product concept eliminates the need for bulky and power-consuming gas sampling systems. The power consumption of the GMP343 itself is low, even below 1 W.

Novel solution for soil respiration measurements

The use of diffusion aspiration eliminates the measurement error caused by pressure differences often present in pump-aspirated measurement systems.

Rugged metal structure

The body of the GMP343 is IP67-classified and suitable for harsh environments. The sensor's diffusion filter protects it from dust and dirt. Heated optics prevent the formation of condensation.

User-configurable measurement

The GMP343 can output both numerically filtered and raw measurement data. The instrument can also compensate the measurement with an internal temperature measurement and user-set relative humidity, pressure and oxygen values.

MI70

In combination with an MI70 indicator, the GMP343 provides an ideal tool for accurate in-situ measurement. The MI70 is used as a display, communication, and data-login device. To achieve most accurate measurements, a Vaisala HMP75 humidity probe can be connected to the MI70 indicator for automatic humidity compensation. In that case a manual compensation is not needed. The optional MI70 Link Windows® software allows transferring logged and real-time data of the GMP343 from the MI70 to a PC.

Calibration

Each GMP343 is calibrated using ±0.5 % accurate gases at 0 ppm, 200 ppm, 370 ppm, 600 ppm, 1000 ppm, 4000 ppm and 2 %. Calibration is also done at four temperature points, -30 °C, 0 °C, 25 °C and 50 °C. If needed, the customer can recalibrate the instrument using the multipoint calibration (MPC) feature allowing up to 8 user-defined calibration points.

With the optional mounting flange, the GMP343 can for example be installed directly into a soil respiration box. The diffusion-aspirated probe eliminates sampling systems and errors related to pressure differences caused by pumps.

Technical Data

Performance

Measurement range options	0 ... 1000 ppm, 0 ... 2000 ppm, 0 ... 3000 ppm, 0 ... 4000 ppm, 0 ... 5000 ppm, 0 ... 2 %

Accuracy (excluding noise) at 25 °C (77 °F) and 1013 hPa after factory calibration with 0.5 % accurate gases with different range options

0 ... 1000 ppm	±(3 ppm + 1 % of reading)
0 ... 2000 ppm - 0 ... 2 %*	±(5 ppm + 2 % of reading)

*Accuracy below 200 ppm CO_2 not specified for 2 % range option

Noise (repeatability) at 370 ppm CO_2

with no output averaging	±3 ppm CO_2
with 30 s output averaging	±1 ppm CO_2

Temperature

Effect on accuracy with temperature compensation:

CO_2 range options	0 ... 1000 ppm	0 ... 2 000 - 5000 ppm	0 ... 2 %
Temperature °C (°F)	Accuracy (% of reading)		
-10 ... +40 (+14 ... +104)	±0.5	±1	±2
-40 ... +60 (-40 ... +140)	±2	±3	±4

For readings below 200 ppm CO_2 ±5 ppm CO_2

Temperature compensation is performed by an integrated Pt1000 element

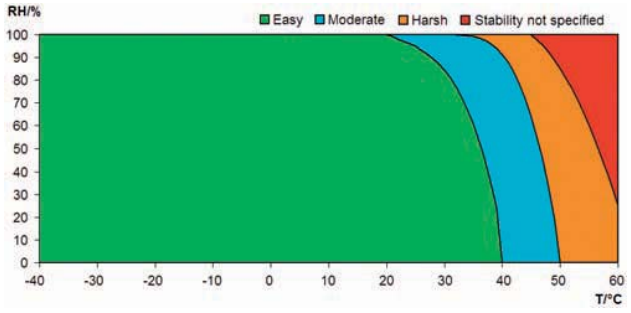
Pressure

Effect on accuracy with pressure compensation:

CO_2 range options	0 ... 1000 ppm	0 ... 2000 - 2 %
Pressure (hPa)	Accuracy (% of reading)	
900 ... 1050	±0.5	±1
700 ... 1300	±1	±2

Integrated pressure sensor is not included in GMP343

Long term stability	see graph below
easy	<±2 % of reading / year
moderate	<±2 % of reading / 6 months
harsh	<±2 % of reading / 3 months



Response time (90 %)

Diffusion model Filter attached	Averaging (s)	Response (s)
Yes	0	75
Yes	30	82
No	0	<2
No	30	30

Flow-through model Gas flow (l/min)	Averaging (s)	Response (s)
0.3	0	26
0.3	30	44
1.2	0	8
1.2	30	23

Warm-up time	
full accuracy ±0.5 %	10 min
full accuracy	30 min

Operating Environment

Temperature	
operating	-40 ... +60 °C (-40 ... +140 °F)
storage	-40 ... +70 °C (-40 ... 158 °F)
Humidity	see graph 'GMP343 Operating Conditions'
Pressure	
compensated range	700 ... 1300 hPa
operating	<5 bar
Gas flow for flow-through model	0 ... 10 liters/min
Electromagnetic compatibility	EN61326, Generic Environment

Inputs and outputs

Operating voltage	11 ... 36 VDC
Power consumption	
without optics heating	<1 W
with optics heating	<3.5 W
Analog outputs	
Current output	
range	4 ... 20 mA
resolution	14 bits
max. load	800 Ohm @ 24 VDC, 150 Ohm @ 10 VDC
Voltage output	
range	0 ... 2.5 V, 0 ... 5 V
resolution	14 bits (13 bits with 0 ... 2.5 V)
min. load	5 kOhm
Digital outputs	RS485, RS232

Materials

Housing	anodized aluminium
Filter cover	PC
IP classification	
Housing (cable attached)	IP67
Diffusion filter (weather protection)	IP65
Diffusion filter (sintered PTFE)	IP66
Cable connector type	8-pin M12
Weight (probe only)	360 g

Options and accessories

Wall mount bracket	GMP343BRACKET
Mounting flange	GMP343FLANGE
Standard diffusion filter (weather protection, IP65) +filter cover	GMP343FILTER
Diffusion filter (sintered PTFE filter, IP66) + filter cover	215521
Calibration adapter (for the diffusion model)	GMP343ADAPTER
Junction box	JUNCTIONBOX-8
Probe cables	
2m	GMP343Z200SP
6m	GMP343Z600SP
10m	GMP343Z1000SP
PC connection cable, 2m	213379
MI70 connection cable, 2m	DRW216050SP
USB adapter (USB-D9 Serial connection cable)	219686
Soil adapter kit for horizontal positioning	215519
Soil adapter kit for vertical positioning	215520

Dimensions

Probe dimensions in mm (inches)	
length	180 (7.1)
diameter	55 (2.2)

For full technical specifications, see the User's Guide

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Specifications are subject to change without prior notice.
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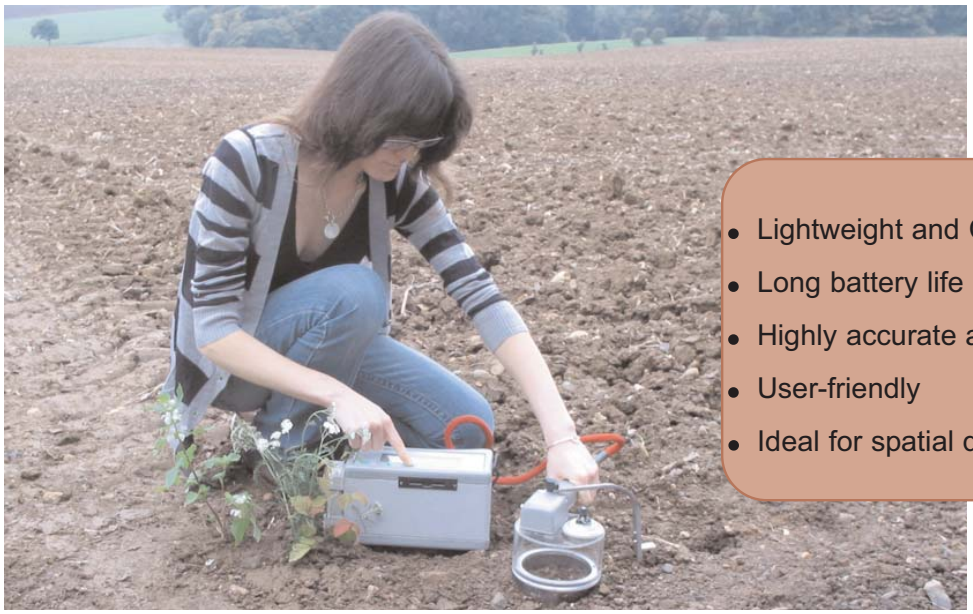
SRS series

Portable soil respiration systems



- Lightweight and Compact
- Long battery life
- Highly accurate analysis
- User-friendly
- Ideal for spatial distribution studies

Soil respiration

Rapidly rising atmospheric CO_2 concentration and its potential impact on future climatic conditions is an issue of increasing global economic and political significance.

Soil respiration or soil flux can be defined as the net CO_2 production of a soil, largely as a result of microbial decomposition of soil biomass. The amount of gas exchange taking place is frequently used as an indicator of the "health" of that soil. The rate of soil flux is influenced by a variety of environmental parameters especially organic matter content, soil moisture and soil temperature.

Natural biomass respiration from soil is a major carbon source. Understanding soil flux and its relationship with other sources and sinks within the carbon cycle are currently subject to increasing scientific scrutiny in relation to global climatic change.

The measurement of soil respiration is also important in bioremediation and pesticide impact research.

ADC BioScientific has developed the SRS series, the SRS1000 and SRS2000, two truly portable soil respiration systems that offer researchers superior performance for a variety of applications including spatial distribution studies.

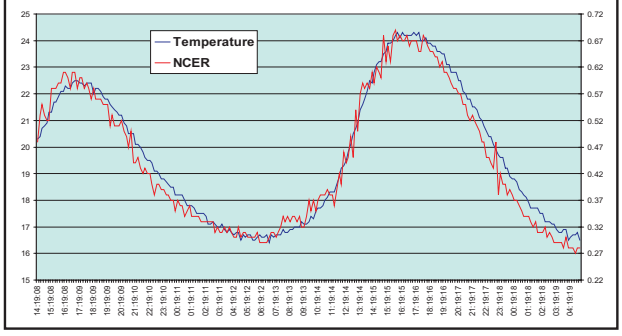
Superior field performance

Both the SRS1000 and SRS2000 consist of a programming console and a soil respiration chamber with an integral CO_2 Infrared Gas Analyser (IRGA), enabling the fastest measurement responses of gas exchanges from the soil.

The systems work in the highly accurate “open system” mode, ensuring that there is no build up of CO_2 concentrations inside the chamber that could potentially suppress soil flux.

The miniaturised IRGA has an operating range of 0-2000ppm CO_2, with a resolution of 1ppm. It has been designed with excellent stability and drift characteristics. All measurements are automatically compensated for changes in atmospheric pressure and temperature.

The graph below shows the excellent stability of CO_2 measurements during a 36 hour diurnal soil flux/temperature plot using the SRS2000.



Grass photosynthesis

The rugged transparent construction of the upper compartment ensures that a true Net CO_2 Exchange Rate is measured, taking in account any small plant material that may be photosynthesising on the soil surface.

The SRS systems may therefore also be used to measure ambient photosynthesis activities by whole small plants or turf grasses. The systems can be easily and quickly configured to display and record full photosynthesis data and calculations.

A number of other plant leaf chambers are available for use with the SRS1000 and SRS2000 enabling photosynthesis analysis measurements on a wide variety of plant species.

These multipurpose gas exchange systems can be used for countless soil flux and photosynthesis applications, offering outstanding value for money for any multi-disciplined research facilities.

ADC:Quality and experience

For over 40 years ADC's name has been synonymous with environmental research, with an outstanding reputation for the development and manufacture of truly field portable instrumentation.

ADC is committed to quality: "**Quality of product and quality of service".**

From design to delivery, ensuring optimal performance and reliability is of paramount importance to our team of experienced engineers. Once in the field you are supported by our network of over 40 customer support centres worldwide.

ADC BioScientific Ltd.

SRS series Specifications

Gas exchange: CO_2: 0-2000ppm, 1ppm resolution
Infrared gas analyser
H_2O: 0-75mbar, 0.1mbar resolution
Two fast response water sensors

Other sensors:
Chamber temperature: 0ºC to 50ºC. Precision thermistor
Soil temperature: 5ºC to 50ºC. Precision thermistor
PAR: 0-3000µmols m^{-2} sec^{-1} silicon photocell

Automated environmental control: (SRS2000 only):
Programming: Automatic and independent control of CO_2 and H_2O within the soil chamber. Single and sequential control levels.
CO_2: Up to 2000ppm by integral elevated CO_2 supply system.
H_2O: Above and below ambient conditions by on-board self indicating conditioning chemicals.

Flow rate to chamber: 0-500ml min^{-1}

Warm up time: 5 minutes @ 20ºC

Display: SRS1000 240 x 64 dot matrix LCD
SRS2000 Graphic display 240 x 64 super twist LCD

Recorded data: Removable PC compatible cards storing unlimited data

Data output: Direct from PC compatible cards and RS232

Battery:
SRS1000 2.6Ah lead acid 12V battery. 10 hr battery life
SRS2000 6.8Ah lead acid 12V battery. Up to16 hr battery life

Battery charger: 90-260V, 50/60Hz

Operating temperature range: 5ºC to 45ºC

Console:
Dimensions SRS1000 23 x 11 x 14cm
SRS2000 23 x 11 x 17cm
Weight: SRS1000 2.4kg
SRS2000 4.4kg

Chamber:
Construction: Collar stainless steel
Upper chamber cast Acrylic
Volume: 1l
Diameter: 130mm
Height: Collar 75mm
Upper chamber 70mm
Weight: Collar 325g
Upper chamber 320g

HOSKIN SCIENTIFIC

SOIL GAS ANALYSIS

Soil gas analysis can yield a lot of information concerning the soil environment. Using a 'piercing probe' and an oxygen content meter the growing conditions for shrubs and trees can be defined. And who would not want to be able to measure the extent of soil pollution in an area without time-consuming soil drilling?

14.35 Soil oxygen content analysis system

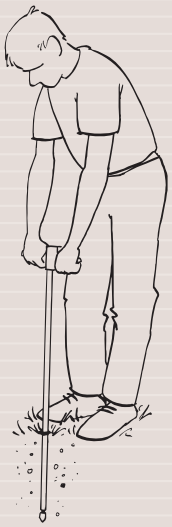
This system consists of a short soil probe and an oxygen content meter. The probe is pushed into the soil manually.

Once at the right depth the probe is lifted slightly. In this way the probe opens itself. Next, the oxygen content meter is connected to the probe and, using a bellows, soil gas is drawn through the meter and the O_2 content is measured, and with that an important growing parameter for trees and plants, can be read. The probe has a small dead volume, so that a measurement can be executed accurately within minutes. The oxygen content meter operates with an electrochemical cell. This cell has a limited service life (about 1.5 years), but can be calibrated easily with air (21%) and with a gas free of oxygen (natural gas, nitrogen).

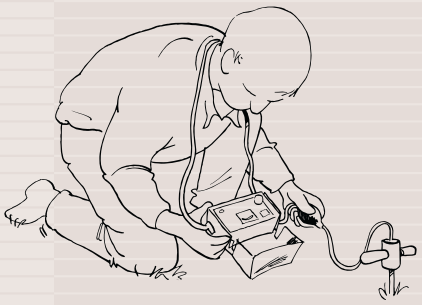
Soil oxygen content analysis system

P1.66

The opening of the soil air probe.



Drawing-in and analysing the soil gas oxygen content.



BENEFITS

14.35 Soil oxygen meter

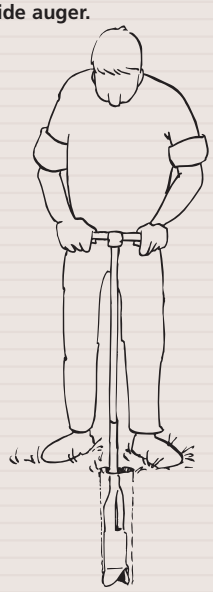
- Sturdy and very simple to operate soil probe
- Immediately shows living conditions for roots
- Meter allows measurements up till 0% O_2

Eijkelkamp Agrisearch Equipment

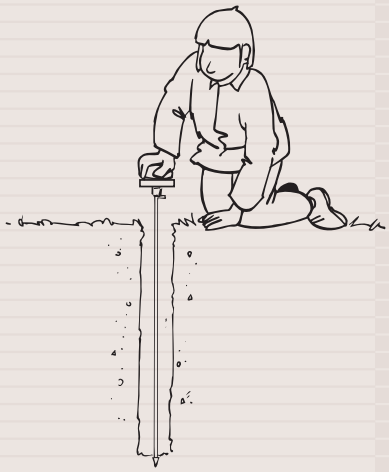
SOIL GAS ANALYSIS

P1.66

To place the oxygen diffusion probe a hole is pre-drilled with a Riverside auger.



The oxygen diffusion probe is pushed into the bottom of the pre-drilled hole.



14.36 Oxygen diffusion meter

In plant cultivation it is very important that the soil has proper ventilation. The necessary oxygen supply for the roots and the discharge of the carbon dioxide gas that is formed there, in case of most cultivated growth, takes place via the soil.

Also soil chemical processes depend on the presence of oxygen in the soil.

The major part of the transport of O_2 and CO_2 is executed via the so called 'gas phase' of the soil, or via the air filled pores. The gas phase is an essential part of the soil; plant growth and soil are seriously influenced by the extend and composition of the gas phase.

The air content of the soil depends on the soil moisture content and the soil structure.

Lack of oxygen (insufficient aeration) may lead to:

- Reduction of root growth.
- Reduced availability of nutrients.
- Reduction of evaporation.
- Reduction of the rate of photosynthesis.

All of this leads to a reduction in the production of plant material.

Gas transport thus is necessary in order to get enough oxygen into the soil. The partial pressure of the oxygen in the soil air due to consumption will be less then in the atmosphere.

As a consequence the diffusion process causes a net supply of oxygen molecules into the soil and, in the other direction, a discharge of the carbon dioxide molecules from the soil. Gas diffusion in the soil almost solely takes place via the continuously air-filled pores (oxygen diffuses through water only very slowly).

Plants need air as well as water, a permanent heterogeneous pore system thus is an essential requirement. Such a pore system is enhanced by the following: activation of soil life; drainage and tillage. The process of aeration is hindered by: soil compaction; the soil being too wet; soaking; paving and adding material.

Oxygen diffusion measurement system

SOIL GAS ANALYSIS

P1.66

The oxygen diffusion meter measures the mobility of oxygen in the soil. A mobility that is important for the availability of oxygen for plants.

The method: measuring the electric current required for the reduction of all oxygen present at the surface of a cylindrical Pt-electrode in the soil. The flow of oxygen through the air-filled pores and the water film on the electrode is measured until the steady state is reached.

The Oxygen Diffusion Rate (ODR) probe (Pt-electrode) should be placed in undisturbed soil. To this purpose a hole is pre-drilled to a depth of approximately 10 mm above the measuring point, after which the probe is lowered and carefully pushed into the bottom of the augerhole. It is advised to remove the electrode from the soil after a series of measurements in order to clean it.

The meter provides a stabilized voltage between the ODR-probe and the Ag-AgCl-reference electrode.

In very dry soils only part of the electrode will be covered in water. This results in a rising impedance between soil and electrode. In such a situation the meter can also be used to perform a redox-potential measurement.

The measuring system consists of a read-out unit with connecting facilities for three ODR-probes, one ODR-probe, one Ag-AgCl reference electrode, KCl-solution and a brass electrode.

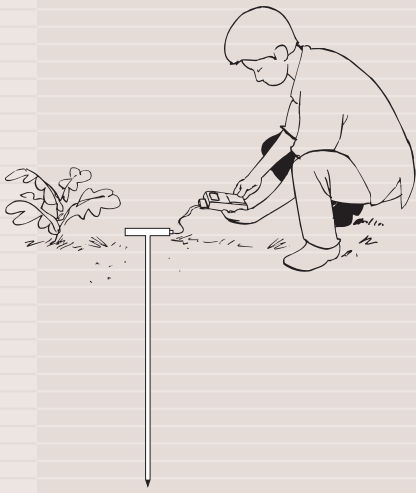
The reference electrode is used for measuring and checking the potential between the Pt-electrode and the soil.

The brass electrode is used to close the electrical circuit.

The measuring range for oxygen diffusion is 0 - 999 µA and for Redox 0 - 999 mV (resolution resp. 1 µA and 1 mV).

Accuracy +/- 3 µA and +/- 3 mV. Operating temperature between 0 and 50 °C and an air humidity between 30 - 80%. The meter is supplied in a case, incl. batteries.

The oxygen diffusion meter is read.



Oxygen diffusion probe

Oxygen diffusion meter

BENEFITS

14.36 Oxygen diffusion meter

- Will determine availability of O_2
- Only useful in growing season
- Instrument for purely scientific research

Eijkelkamp
Agrisearch Equipment

HOSKIN SCIENTIFIC

Galvanic Soil Oxygen Sensors

Model O2S-F and Model O2S-D

This sensor measures the amount of Oxygen (O_2) gas in air. Model O2S-F and Model O2S-D are galvanic cell type oxygen sensors. Models O2SF and O2S-D both have a lead anode, a gold cathode, an acid electrolyte and a Teflon membrane. The current flow between the electrodes is proportional to the oxygen concentration being measured. An internal bridge resistor is used to provide a mV output. Being a galvanic cell type sensor, a small amount of oxygen is consumed in the reaction in order to produce the current flow and subsequent mV output. The oxygen consumption was measured to be 2.2 µmol O_2 per day when the O_2 concentration was 20.95% (3240 mmol) at 23 ^{o}C.

The mV output responds to the partial pressure of oxygen in air. The standard units for partial pressure are kPa. However, gas sensors that respond to partial pressure are typically calibrated to read out in mole fraction of the gas in air, which has units of moles of oxygen per mole of air. These units can be directly converted to % O_2 in air or ppm O_2 in air.

Gas sensors read out in percent because this value does not change with temperature or pressure. The concentration of oxygen in our atmosphere is 20.95%, and this value, to 4 significant digits, has not changed for decades. This means that we are surrounded by calibration gas for this sensor (provided you are not breathing on the sensor when it is being calibrated. Our exhaled breath is about 17% oxygen).

NEW (02.14.06) We are pleased to announce that we now have two versions of the Oxygen Sensor: a "STANDARD RESPONSE" unit for soil applications and a "FAST RESPONSE" unit for laboratory applications.

OXYGEN SENSOR SPECIFICATIONS	
OPERATING ENVIRONMENT	5 to 40 °C; 0% to 100% oxygen
OPERATING PRESSURE RANGE	500 hPa to 1520 hPa (approx. 0.5 to 1.5 atm)
OUTPUT	STANDARD RESPONSE SENSOR (-STD): approx. 50 mV at 20.95% O_2 at sea level FAST RESPONSE SENSOR (-FR): approx. 12 mV at 20.95% O_2 at sea level Must be calibrated by end user
DIMENSIONS	SENSOR BODY: 2.37" long, 1.25" dia.; 1/2" x 20 threaded end FLOW-THROUGH HEAD DIMENSIONS: 1.25" long, 1.25" dia., 1/8" x 3/8" thread through, 1/2" x 20 thread to accept sensor body DIFFUSION HEAD DIMENSIONS: 1.375" tall, 1.375" dia., 125 mesh screen, 1/2" x 20 thread to accept sensor body
MASS	175 g
RANGE	0 to 100% oxygen
CABLE	3 meters of shielded, twisted 6-conductor cable *FOR SENSOR WITH THERMISTOR:* Red: high side of differential channel (+ lead for sensor) Black: low side of differential channel (- lead for sensor) Clear: analog ground (ground for sensor) Green: high side of single-ended channel (+ lead for thermistor) Orange: analog ground (- lead for thermistor) White: excitation channel (excitation for thermistor) Yellow: 12V port (+ lead for heater) Blue: ground (- lead for heater) *FOR SENSOR WITH THERMOCOUPLE:* Red Wire = high side of differential channel (+ lead for sensor) Black Wire = low side of differential channel (- lead for sensor) Clear Wire = analog ground (ground for O_2 sensor) Green Wire = 12V port (+ lead for heater) White Wire = ground (- lead for heater) Yellow Wire (type-K thermocouple) = high side of differential channel (+ lead for t/c) Red Wire (type-K thermocouple) = low side of differential channel (- lead for t/c)
REPRODUCIBILITY	+/- 0.2% O_2 (typically +/- 1% O_2)
WARRANTY	1 year parts and labor

The world's most advanced PID

...Just got better!!

VOC's from ppb up to 10,000 ppm
in one instrument

PHOCHECK +®

Applications include:

- STEL and TWA monitoring
- Atmosphere monitoring
- Environmental clean-up
- Landfi ll surveillance
- Petrochemicals
- Confi ned space entry
- First response HazMat/WMD
- Industrial painting
- Arson Investigation
- Leak detection
- Indoor air quality
- Soil contamination

PhoCheck is registered in the U.S. Patent and Trademark Offi ce.

ION science INNOVATION

HOSKIN SCIENTIFIC

PHOCHECK® +

Technical Specification

DETECTOR
Ion Science Photoionisation Cell**
Fitted with unique 'Fence Electrode' technology**
- Greater measurement stability, accuracy and linearity
- Improved resistance of relative humidity effects
- T90 ~ 1 second rise and clear-down

LAMPS
10.6 eV Krypton PID lamp supplied as standard
Other lamps available please see accessories for details

INTRINSICALLY SAFE APPROVALS
Ex II 2 G Baseefa 03ATEX0742
EEx ia II T4 (-20 °C ≤ Ta ≤ 60 °C)
IECEx BAS 04.0033 (world standard)

ACCURACY
± 5% displayed reading ± one digit

LINEARITY
± 5%

DATA LOGGING*
Automatically recording readings every second including date and time stamp.
8 Mb data memory
Incorporates a secure storage algorithm to reduce stored data corruption

CALIBRATION
Via calibration kit accessory

OPERATION
Dry Cell: Alkaline 4 x AA - 20 hours
Rechargeable NIMH: 20 hours

ALARM
Flashing LED and 90 dBA (10 cm) audible sounder
Pre-programmed TWA and STEL*
Pre-programmed 250 gas and gas cocktails*

INSTRUMENT RANGE*
Maximum range: 1 ppb to 10,000 ppm
Maximum range: 0.01 to 10,000 mg/m ^{3}

FLOW RATE
220 ml/min or 220 cc/min with fl ow fail alarm

TEMPERATURE
Operating: -20 to 60 ˚C, -4 to 140 ˚F
Humidity: 0-99% RH (non condensing)

WEIGHT & DIMENSIONS
Instrument without probe
340 mm (13.5") L x 60 mm (2.3") W x 49 mm (1.9") H
Standard case
420 mm (16.5") x 320 mm (12.5") x 97 mm (3.8")
Instrument 0.58 kg - 1.3 lb. Packed 3.0 kg - 6.6 lb

EMC tested to EN61000-6-3 & EN61000-6-1 2001
All specifi cations are against isobutylene calibration at 20 °C, 90% RH and up to 3000 ppm
* model and gas dependent
** PCT Application WO 03/046535

ION SCIENCE is ISO9001:2000 certifi ed (December 2003)

PhoCheck features and upgrade options

Key
Standard feature = n Upgradeable = o

Feature	1000	1000Ex	2000Ex	3000Ex	5000Ex
Intrinsically safe ATEX Approval		n	n	n	n
Health and Safety mode for STEL and TWA monitoring		o	o	n	n
IRDA for wireless communications with a PC		n	n	n	n
Auto range ppm/ppb		o	o	o	n
Real-time graph display on screen		n	n	n	n
Simple data store	n				
Data logging		o	n	n	n
Date and Time stamp		o	n	n	n
Ion PC software for instrument configuration and data handling		n	n	n	n
Easy to use icon based interface	n	n	n	n	n
Zone name creator		o	n	n	n
Audible alarm 90 dBA	n	n	n	n	n
Visual alarm (LED)	n	n	n	n	n
Gas table of 250+ gases and their individual response factors		n	n	n	n
Selectable mg/m ^{3} or ppm/ppb		n	n	n	n
Upgradeable to FirstCheck+ range to include O_2, CO, H_2S and LEL		o	o	o	o

Accessories

Ion Science has developed an exclusive range of high quality accessories to compliment all the PhoCheck models. Please see a selection of these below, for a full list see a member of our sales team.

Part No.	Accessories
A-830206	IS protective cover Ex II 1 G EEx ia IIC T4 Baseefa02ATEX0093X, Baseefa03ATEX0742X, Pk of 10
A-845213	Calibration kit
A-31063	PID lamp cleaning kit
A-31057	Carbon fi lter (Zero fi lter)
A-31064	25 mm (1") diameter 0.5 micron probe fi lters, PK of 5
A-31066	Std probes attachment PK of 5
30618	PID lamp 8.4 eV Xenon
30619	PID lamp 10.2 eV Deuterium
30620	PID lamp 10.6 eV Krypton
30621	PID lamp 11.7 eV Argon
31052	Leather instrument jacket
40052	Leather instrument jacket with magnetic attachment
4/VH-01	Instrument chest harness for hands free operation
A-30555	5 m (16 ft) fl exible extension hose
A-30556	10 m (33 ft) fl exible extension hose
A-31153	Exhaust barb, Tedlar bag connector

This publication is not intended to form the basis of a contract and specifications can change without notice.

ION Science INNOVATION

INNOVATION
INNOVATIVE LEAK DETECTION SOLUTIONS

HOSKIN SCIENTIFIC

WATER INFILTRATION MEASUREMENTS

P1.61

The measure of infiltration of water into the soil is an important indication concerning: the efficiency of irrigation and drainage, optimizing the availability of water for plants, improving the yield of crops and minimizing erosion.

09.04 Double ring infiltrometer

The double ring infiltrometer is a simple instrument that is used to determine the rate of infiltration of water into the soil.

The rate of infiltration is determined as the amount of water per surface area and time unit, that penetrates the soil. This rate can be calculated on the basis of the measuring results and the Law of Darcy.

The standard set of the double ring infiltrometer consists of a number of sets of stainless steel rings with different diameters (for reasons of transportation).

Several measurements can be executed simultaneously, yielding a very reliable and accurate mean result. As vertically infiltrated water runs away to the sides, the outer ring of the infiltrometer serves as a separation. The measurements exclusively take place in the inner ring through which the water runs virtually vertical.

To achieve good measuring results it is important to take into account several factors that may influence the measurement: the surface vegetation, the extent to which the soil has been compacted, the soil moisture content and the soil layers (strata). The best measuring results are obtained at 'field capacity' of the soil.

The ring infiltrometer may be used for determining the rate of infiltration and capacity for irrigation and drainage projects, studying drainage, determining the intensity of artificial precipitation and the effect of treatment of the soil.

Double ring infiltrometer, complete set

The inner- and outer ring are driven a number of centimeters into the soil by means of a driving plate and an impact absorbing hammer.

Because the inner- as well as the outer ring are filled with water, the water flows virtually vertically through the inner ring into the soil.

BENEFITS

09.04 Double ring infiltrometer

- Ideal for infiltration measurement of top soils
- Perfect for flood / furrow irrigation advice
- Triple rings to get a representative average
- Stainless steel rings will last forever

Eijkelkamp Agrisearch Equipment

Guelph Permeameter
Model: E-127-2800K1

Features:
- easy to use instrument for measuring in-situ hydraulic conductivity
- accurate evaluation of soil hydraulic conductivity, soil sorptivity, and matrix flux potential can be made in all types of soils
- equipment can be transported, assembled, and operated easily by one person
- measurements can be made in 1/2 to 2 hours, depending on soil type, and require only about 2.5 liters of water
- measurements can be made in the range of 15 to 75 cm below the soil surface

Complete kit consists of:
- permeameter
- field tripod
- well auger
- well preparation and cleanup tools
- collapsible water container
- vacuum test hand pump
- durable carrying case

Accessory attachments are available for extending the measurement capability of the permeameter. Depth attachments increase the depth of operation by 80 cm. The maximum practical operating depth is 315 cm. Ring attachments allow ring Infiltrometer measurements from 10-cm and 20-cm diameter rings. A tension adapter allows measurements to be made under tensional and very low head conditions.

Gee Passive Capillary Lysimeter
Model: E-240-40340

Monitor Groundwater Leaching
Use the Drain Gauge to determine the volume of water and chemicals draining from the vadose zone into groundwater.

Identify Contamination
The one and a half meter tall Drain Gauge is buried directly in the ground to measure flow rate in unsaturated soils and collect soil water samples for chemical analysis. Water samples can be collected easily through a surface port to analyze for chemicals, fertilizers, and other contaminants.

Measure Deep Percolation Accurately
One of the challenges with lysimeter measurements is that water tends to flow around receptacles buried in the ground. The drain gauge uses an ingenious duct and wick design to apply a constant tension and keep the flow rate within the gauge equivalent to the flow rate in the surrounding soil.

Made from Non-reactive Materials
The Drain Gauge is constructed from inert materials, so chemicals won't react with the tube, the sensors, or the collection reservoir.

Applications:

- Waste Landfill Sites. Used to identify drainage and monitor efficacy of cover systems.
- Food Processing Waste Sites. Maximizes applications by monitoring water drainage rates and water quality below the root zone.
- Environmental research. Measures percolation and recharge rates.
- Farming operations. Measures and informs irrigation during a cropping season.
- Golf Courses. Used to measure and control excess water applications and fertilizer losses.

IN SITU HYDRAULIC CONDUCTIVITY TESTS

P1.60

09.11 Ksat constant head permeameter

The Ksat constant head permeameter is an instrument that provides the means to collect data for determining in situ saturated hydraulic conductivity of the vadose (unsaturated) zone easily and conveniently. The measuring procedure is known as constant head well permeameter technique, shallow well pump-in method or borehole infiltration test. Before the equipment is used a hole is augered (the bottom of the hole must be plane (use the Riverside auger).

The main unit is used for measuring hydraulic conductivity to a depth of 2 m. The depth of measurement can be easily increased to 4 m by attaching a set of constant head tubes to the main unit. To measure below 4 m depths, a special flow measuring reservoir and a pressure transducer (available as optionals) are required.

The standard set (for a depth of 2 m) contains: the compact constant head permeameter and augers for installation.

Advantages

- Compact, portable and versatile.
- No field assembly is required.
- 5 Liter useful water capacity allows measurement of hydraulic conductivity in most soils.
- Large opening for quick filling and refilling of the reservoirs.
- Can be used on any landscape position without an external support.
- Can be easily transported as a back pack for measurement in remote locations.
- Constructed of durable PVC and polycarbonate to withstand field use.

Applications

- In situ permeability tests for drainage and/or irrigation.
- Determination of hydraulic conductivity of the unsaturated zone for septic system design, landfill design, and retention pond construction.

By using an extension kit hydraulic conductivity can be measured below 4 m.

Ksat constant head permeameter

BENEFITS

09.11 Ksat permeameter

- Determines permeability in any layer < 2 m
- Meant for above the groundwater table
- Stable compact and versatile instrument
- Steady state principle for optimum accuracy

Eijkelkamp Agrisearch Equipment

HOSKIN SCIENTIFIC

Mini-disk Infiltrometer
E-240-40300

Throw it in Your Backpack

Just under 33 cm long, the Minidisk Infiltrometer can make field measurements with the just the water from your water bottle. Adjustable suction and porous stainless steel contact plate assure a reliable soil hydraulic conductivity measurement.

Infiltration Rates

It's ideal for irrigation system design, classroom instruction, erosion hazard evaluation, burn severity studies, and many other applications.

Hydraulic Conductivity

Download the Excel macro (see Support tab) and input soil texture and water level readings vs. elapsed time to get hydraulic conductivity.

DECAGON DEVICES

Specifications:

Total Length:	32.7 cm
Diameter of Tube:	3.1 cm
Volume of Water Required to Operate:	135 ml
Sintered Stainless Steel Disc:	4.5 cm diameter, 3 mm thick
Length of Water Reservoir:	21.2 cm
Length of Suction Regulation Tube:	10.2 cm
Length of Mariotte Tube:	28 cm
Suction Range:	0.5 to 7 cm of suction

HOSKIN SCIENTIFIC

Tension Infiltrometer

Model: E-127-2826D

The 2826D tension infiltrometer is designed to measure the unsaturated flow of water into soil rapidly, accurately, and easily. Applications of the infiltrometer include measurement of macropore and preferential flow, estimation of soil structure, and characterization of the soil hydraulic conductivity water potential relationship.

Design Features:

The 20 cm diameter infiltrometer has been designed to operate in two modes. In mode one the infiltration disc is separated from the water tower. In mode two the infiltration disc is attached to the bottom of the water tower, using the supplied connector. Operating the infiltrometer in mode one is especially advantageous when taking measurements under windy conditions. If the infiltration disc is attached to the water tower, even small movement of the water tower by wind, or by accidentally touching it, will affect the contact between the disc and the soil surface and thereby the rate of infiltration of water into the soil. By separating the control tower from the disc, chances of affecting the contact between the disc and the underlying soil are greatly reduced. A second advantage of operating the infiltrometer in this mode is that the weight of the infiltrometer disc is constant during the measurements. In mode two the weight of the infiltrometer, and thus the pressure on the soil surface, changes during measurements as the water tower empties. Operating the infiltrometer in mode two is advantageous where space is limited, such as in a soil pit or in a small excavation.

In both modes 1 and 2 the water level in the water reservoir can be determined by reading the level on the attached centimeter scale, or by measuring the pressure in the upper end of the water reservoir. The pressure in the air pocket at the top of the water reservoir (always negative) is linearly related to the height of water in the reservoir. A centimeter change in water height means a centimeter change in pressure in the air pocket. Thus, infiltration rates can be monitored by recording pressure changes measured with a pressure transducer with digital read-out, or with pressure transducers and a datalogger over time. Using two pressure transducers, one on top of the water reservoir, and a second one mounted on the infiltrometer disc, gives the most complete information. Using two pressure transducers virtually eliminates bubbling 'noise' which increases measurement precision (Ankeny, et.al. 1988).

Remote Tempe Cell Kit

Model: E-127-1428K

There are times when you'd like to have a portable soils lab to get reasonable moisture retention curves for the 1 Bar range or do some flow studies in a remote location without compressors or electricity. Why not consider the model 1428 K series for doing those tests right on the spot.

It's all packed away in a waterproof case for easy transport and includes everything you'll need. 1428K1 Remote Tempe Kit, for vacuum extractions

- Includes 5ea. 1400D2.25-B1M5 Tempe Cells with 5 ea. 206L06TB Brass Cylinders 6cm long - all assembled and ready to go. In addition there's 2005G2 Vacuum Hand Pump with gauge, Pressure - Vacuum Reservoir with 5 port inlet (not shown), 5ea. 50 ml vacuum flask (not shown), 1ea. battery operated scale 500 gm -.01g precision (not shown), Specialized Tempe Stand (for 5 Tempe's) and all associated clamps, tubing, tees to get it all up and running. 1428K2 Remote Tempe Kit, for pressure or vacuum extractions replaces the 2005G2 Vacuum Pump with our portable 2008 Electric Pressure/Vacuum pump housed in its own separate carrying case (not shown see product 2008) and 5 ea. 1405B02M1 Tempe porous plates, 2.25 dia., 2 Bar. for pressure extraction to 2 Bars.

SPECIFICATIONS:

1428K1 REMOTE TEMPE KIT, Vacuum Extraction Kit, Includes, 5ea. 1400D2.25, Vacuum Flasks, Hand Vacuum Pump,
Vacuum /Pressure Reservoir, Special Tempe Stand, associated hoses connectors. In carrying case.

1428K2 REMOTE TEMPE KIT, Pressure/ Vacuum Extraction Kit, 5ea. 1400D2.25, Vacuum Flasks, 2008 Pres./Vacuum Pump, Vacuum Flasks, Vacuum /Pressure Reservoir, Special Tempe Stand, 5ea
1405B02M1 2 Bar Plates, associated hoses connectors. In carrying case.

ACCESSORY ITEMS

0200 SOIL CORE SAMPLER, using 6cm long brass or stainless steel cylinders

6952V12-110 12VDC to 110 VAC charger for the 2008 Pressure / Vacuum pump.

SOIL AIR PERMEABILITY TEST

P1.88

The soil pore system is dependent on the quantity, shape and continuity of pores. It can be described by the water and air permeability of the soil. Permeability to fluids is quantified by hydraulic conductivity or air permeability, respectively.

Eijkelkamp Agrisearch Equipment supplies an comprehensive air permeameter set to measure air permeability, soil moisture tension and volume percentage soil moisture in the field and in the laboratory.

14.34 Air permeameter to measure and register the air permeability of soil and soil samples (in situ and in the laboratory.

The very comprehensive set includes a standard air permeameter for connection to various chambers. With a measuring range of 0.03 - 60 cm/sec. The air permeameter has a built-in datalogger and RS 232 output and is also equiped with a connection plug for a tensiometer and soil moisture sensor.

The instrument is supplied together with software and charger. The stored data can be transferred to a PC for further processing.

In the set 3 different chambers are included to measure:

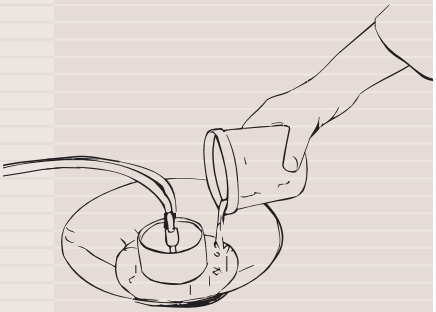
- Homogeneous flow according to Darcy, with integrated pressure sensor. With connection tube and quick connect coupling. The measuring chamber is pressed several centimetres into the soil.
- Heterogeneous flow in undisturbed soil. The measuring chamber is placed on the soil (incl. ring screen).
- Air pemeabilty in undisturbed samples in 250 cc soil sample rings (diameter 84 mm).

The set includes also an electronic tensiometer and a soil moisture sensor (TDR principle) for connection on the air permeameter.

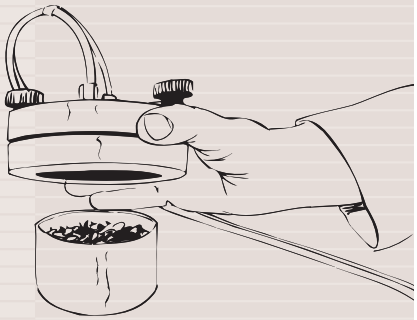
An electronic balance is included to weigh the samples. A calibration measuring chamber for the air permeaneter is also part of the set.

Air permeameter, comprehensive set

A viscous gel is applied to seal the space between the ring screen and the measuring chamber.



The sample ring is placed in the measuring chamber.



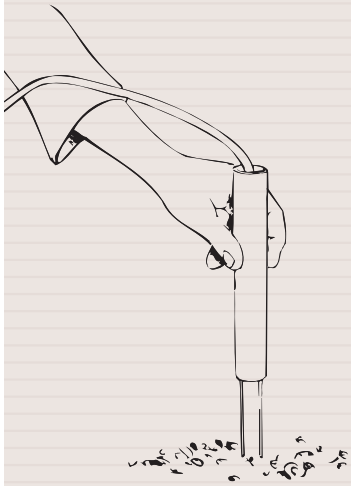
Eijkelkamp Agrisearch Equipment

HOSKIN SCIENTIFIC

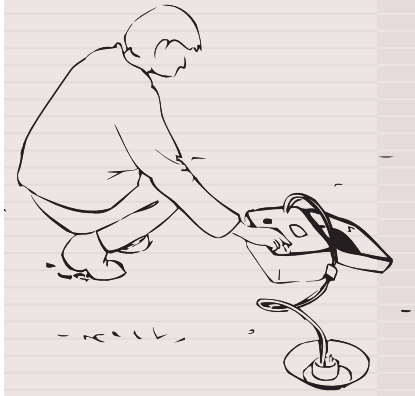
SOIL AIR PERMEABILITY TEST

P1.88

The soil moisture sensor is pressed into the soil.



Reading out measurements in the field.



The data can be read out and processed on a PC.

Measuring principle

By analogy to hydraulic conductivity, air permeability is defined according to Darcy's equation as the factor of proportionality between the rate of air flow and the pressure gradient along the flow distance. The air permeameter realizes the respective flow forms with different measuring probes.
A suitable measuring chamber produces a defined air flow in the test soil volume. Its flow rate is determined from the pressure gradient over a calibrated throat in the measuring device. The pressure difference over the soil volume that has been passed by the flow is recorded by another pressure sensor and provides the pressure gradient of that flow.

Advantages

- Air permeability exactly according to Darcy's definition.
- Short measuring time, with low measuring pressure.
- No sampling.
- Various measuring chambers available.

Technical specifications

Measuring range	: 0.003 - 3 cm/s of air permeability
Measuring pressure	: 1 - 3 hPa
Stabilization time	: ca. 2 sec.
Chamber diameter	: 72 mm
Tension measuring range	: 0 - 800 hPa
Soil water measuring range	: 0 - 60 Vol. %
Data memory	: ca. 1000 measurements

Application

- Soil physics: permeability, compaction, rootability.
- Landfills: control of sealings and cover layers.
- Composting plants: process control via permeability with gas analysis.

Measuring chamber for heterogeneous flow

Measuring chamber for soil sample rings

Measuring chamber for homogeneous flow

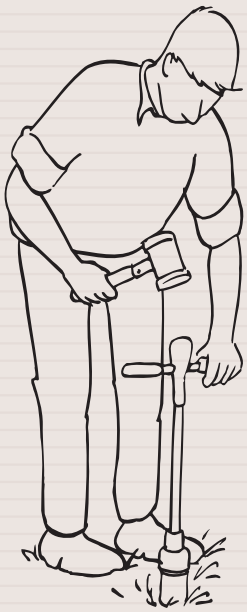
Tensiometer and soil moisture sensor

SOIL WATER PERMEABILITY TEST

P1.87

For laboratory tests undisturbed samples in sample rings are necessary: before sampling the cutting shoe (with sample ring in it) is connected to the ringholder.

An undisturbed sample is taken with the ringholder, whereafter it will be analysed in the permeameter.



The planning and execution of hydrological- and soil technical projects (for instance drainage and irrigation) is almost always preceded by geo-hydrologic research. The water and air permeability of the soil to a large extend determines how efficient an irrigation- or drainage system functions.

Determining the saturated water permeability (horizontal as well as vertical) can be executed in the field (see P1.60) or in the laboratory with a soil water permeameter.

In case of the laboratory soil water permeameter use is made of undisturbed soil samples taken in soil sample rings with the soil sample ring kit (see also P1.31).

09.02 Soil water permeameters

In principle it is possible to design the soil water permeameters in any required size. The size is determined by the number of soil samples of which the saturated water permeability is to be determined simultaneously.

Designs for 5 up to 25 soil sample rings can be supplied.

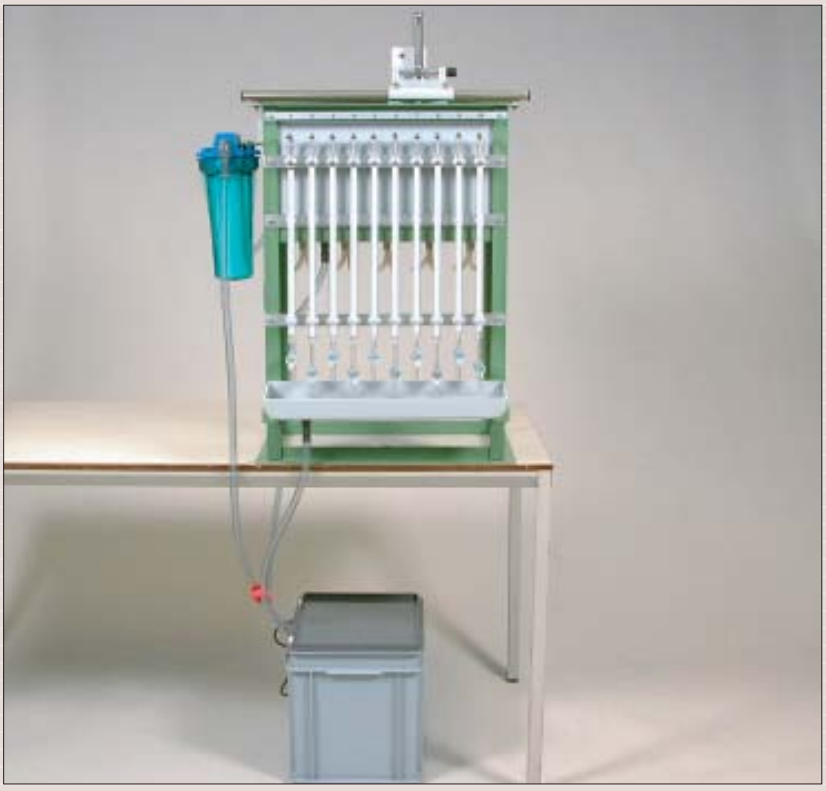
The permeameters are available for soil sample rings with an external diameter of 53 or 60 mm.

A closed or an open system can be applied. In case of a closed system a storage cistern, a circulation pump and a filter are provided.

If an open system is applied these attributes are not needed, as in this case the setup allows a connection to the main water supply and drainage to take place in a washing basin.

A closed system offers the facility to measure other fluids than water from the main water supply.

In case of samples from a salty environment, for instance, salt needs to be added to the water.



Soil water permeameter for 10 samples, closed system

SOIL WATER PERMEABILITY TEST

P1.87

Advantages

The advantages of a closed permeameter compared to an open system are:

- Location independence as no drainage is needed.
- Constant water temperature, equal to the temperature in the laboratory, guarantees constant viscosity.
- Always the same water quality.
- Saves water.

Applications

The soil water permeameter is used for measuring the saturated permeability of undisturbed soil samples in sample rings.
The permeability factor (K-factor) gives accurate information about:

- The presence of disturbing soil layers which prevent a speedy outflow of precipitation.
- The correlation between permeability and other soil properties such as porosity, granular composition, etc.
- The vertical and horizontal permeability.

With these data one can derive further conclusions for the benefit of:

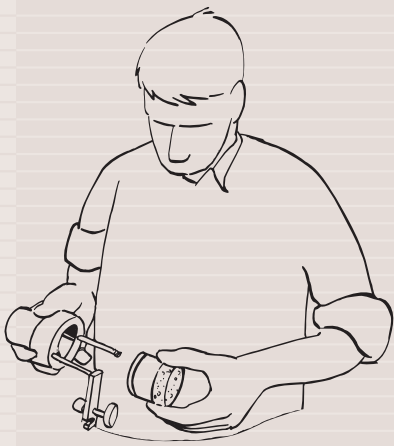
- Irrigation and drainage systems.
- Well pumping.
- Subsidence phenomena.
- Predictions concerning the spread of polluting fluids resulting from calamities.
- Soil improvement- and maintenance advice.

Measuring bridge of permeameter

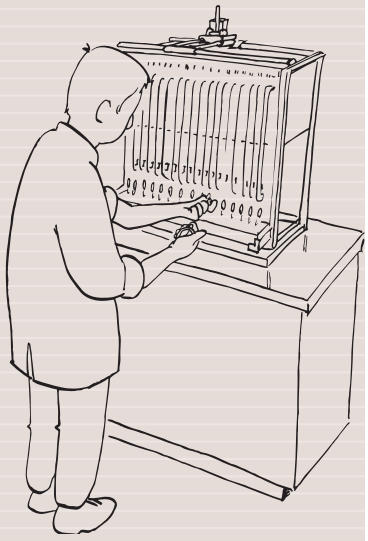
Soil sample ring kit, complete set

Sample ring cartridge

The soil sample ring fitted with a sieve disc and filter gauze is placed in the sample ring cartridge of the permeameter.



By catching the drained water in a burette during a fixed period of time (cm³/min) and applying a certain formula, the K-factor (=permeability factor) of the soil sample involved, can be determined.



Eijkelkamp
Agrisearch Equipment

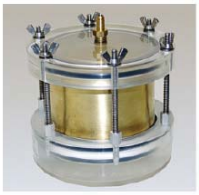
HOSKIN SCIENTIFIC

1400 Series Tempe Pressure Cells

Model: E-127-1400D...

The Model 1400 Tempe Pressure Cell is used to determine the water-holding characteristics of a soil sample in the 0 to 1 bar pressure range. The cell accepts an undisturbed soil sample contained in a 2-1/4" (5.7 cm) diameter cylinder, such as that taken with the Model 0200 Soil Core Sampler. Smaller cores may be placed inside the 2-1/4" diameter brass cylinder if desired. The Tempe cell comes with top and bottom Plexiglass plates, a porous ceramic plate, a brass cylinder, and all sealing and connecting hardware. A variety of porous ceramic plates and brass cylinders are available. An external pressure source is connected to the Tempe cell using Neoprene tubing.

1400D2.25 Series (typ)



When assembled with 1403L Cylinder

Uses 1430 Ceramic Plates. Look below to select

Select options:

Part number	Description
1400B0.5M2-3	TEMPE PRESSURE CELL, 1/2 bar plate, with 2-1/4" (5.7 cm) OD x 3 cm cylinder
1400B0.5M2-6	TEMPE PRESSURE CELL, 1/2 bar plate, with 2-1/4" (5.7 cm) OD x 6 cm cylinder
1400B01M1-3	TEMPE PRESSURE CELL, 1 bar standard plate, with 2-1/4" (5.7 cm) OD x 3 cm cylinder
1400B01M1-6	TEMPE PRESSURE CELL, 1 bar standard plate, with 2-1/4" (5.7 cm) OD x 6 cm cylinder
1400B01M3-3	TEMPE PRESSURE CELL, 1 bar high flow plate, with 2-1/4" (5.7 cm) OD x 3 cm cylinder
1400B01M3-6	TEMPE PRESSURE CELL, 1 bar high flow plate, with 2-1/4" (5.7 cm) OD x 6 cm cylinder

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Column Transport System

Model: E-127-1448

Our 1440DL Series Test Cell is used to study the movement of water and contaminants, tracers, nutrients, colloids, etc. through soil. The Test Cells have multiple testing functions. Primarily they are used as Flow Cells designed to measure the hydraulic properties (both saturated and un-saturated hydraulic conductivity) of porous matter; contaminant and gas transport parameters, and for break-through curves. In their least function, they can be used to determine moisture retention relationships on disturbed columns. You get precision control of application parameters using programmable 10 port specialty syringe pump in determining the solution provided. 3ml syringes provided with the system with other sizes available separately in 6 and 10 ml volumes. The system requires 1440DL Series of Flow Cells (sold separately) to hold soil samples under study. The large evacuated Column Transport
Chamber allows for fraction collection of up to 3 flow cells mounted on the acrylic cover.
Comes Complete.

SPECIFICATIONS:
1448 COLUMN TRANSPORT SYSTEM, for 3ea. 1440DL Flow Cells, complete with syringe pump,. Will require additional 1440DL Flow Cells sold separately.
Shipping Information:
5 Boxes 10 Cubic Feet, 92 lbs

Mini Trase Kit

Model: E-127-6050X3K1B

The MiniTrase uses Time Domain Reflectometry (TDR) to measure instantaneously the volumetric water content of soils and other moist media. A variety of connectors and waveguides for depth measurements ranging from 15 cm to 70 cm are available, and can be used in a portable manner or permanently installed for periodic moisture monitoring. The volumetric moisture content is displayed on the Palm terminal, and the graph of the TDR pulse can also be tagged for identification and stored for later viewing and analysis on the PC. All stored data can be transferred either by hotsyncing the Palm to your PC or via an RS-232 port connection from the MiniTrase to the PC. The MiniTrase unit is designed for rugged field use and is environmentally sealed to prevent damage to sensitive electronic components.

Kit includes: Mux card, cables, chargers, Palm, software.

Profile Probe

Model: E-312-PR

- Soil moisture content - not just trends
- Low salinity and temperature sensitivity
- Portable meter option for convenient multi-site measurement
- Dedicated DL6 Logger option for continuous monitoring
- Out of the box solution - supplied with soil calibrations for common soil types
- IP68 protected connectors for versatile connectivity
- Uses access tubes for easy probe insertion and removal

No other system enables you to monitor your soil water profiles with such ease and flexibility. Install an access tube into the soil, insert the PR2 Probe and press the HH2 [Read] button to display an instantaneous reading, or connect the PR2 to a data logger (DL6 or DL2e) and leave the system to record soil moisture changes over time.

The PR2 Profile Probe is built around newly patented sensing technology* which provides unprecedented performance in all soil types, with minimal influence from either salinity or temperature. The PR2/4 model measures soil moisture at 4 depths down to 40cm or the PR2/6 measures at 6 depths down to 100cm.

The PR2 access tube requires an installation hole 27mm in diameter, allowing easy installation and minimal soil disturbance. Access tubes are manufactured to strict tolerances and are exceptionally strong and durable in the soil. Correct installation is essential and we recommend the use of our specially designed augering equipment.

* patent pending

ThetaKit type TK3

The ThetaKit provides precision soil moisture data. It is easy to use, dependable, affordable - and ideal for use on golf courses

- **Spot check soil moisture content quickly and easily**
- **Check the performance of automatic sprinklers**
- **After saturation, determine the holding capacity of fairways, greens and tees, to optimise moisture level for best play and appearance**

Achieving the highest standards of turf management requires the very best equipment available. Designed originally for scientific applications, the ThetaKit gives greenkeepers access to research quality equipment - but with the complexity removed. You simply push the probe into the soil, press a button and read off the moisture content from the LCD.

Features

- Waterproof and rugged
- Stable performance - even in saline soils
- Minimal disturbance to soil
- Readout unit stores up to 2100 readings
- Readings can hold identification numbers for plot and sample

Irrigation monitoring

Irrigation systems, whether manual or automatic, can have problems with uneven water distribution. This can be caused by damage to sprinkler heads, poor positioning, wind effects or changes in water pressure. Dry spots or over-watered areas often develop unnoticed, but regular monitoring of soil moisture content can give the turf manager early warning and the opportunity to take preventative action.

ThetaKit

This portable kit contains everything you need to make rapid spot readings of soil moisture content:

- **ThetaProbe type ML2x/d** - with 2m cable length
- **Spare ThetaProbe rods** - pack of 4
- **Moisture Meter type HH2** - with spare battery
- **Insertion Kit type ML-INK1** - for use in hard soils
- **Carrying Case type HHCC1** - to hold all items in kit

ThetaProbe type ML2x

Simple to use The ThetaKit is a portable, reliable, accurate soil moisture measurement system for instantaneous readout of soil moisture. Simply insert the ML2x ThetaProbe into the soil, connect to your HH2 Moisture meter and within seconds you can be measuring soil moisture. Thousands of ThetaProbes are in use all over the world, in a wide range of applications.
The narrow rods with sharp tips minimize errors due to soil compaction. They are highly resistant to corrosion, can withstand repeated insertion in soil - and can be replaced at low cost if bent or damage.

NB This leaflet only covers the use of the ThetaProbe as part of a ThetaKit. However, the ThetaProbe can also be used with extension tubes for deeper measurements, or buried at depths of up to 5m. It can also be connected to a data logger. Please request our Soil and Plant Water Measurement catalogue for further details, or visit www.delta-t.co.uk.

Calibration For convenience, many users simply apply one of the two standard calibrations supplied by Delta-T. With these "generalised" mineral or organic calibrations, 5% accuracy can be achieved. Alternatively, after a single two-point gravimetric calibration, ThetaProbes will meet their full 1% accuracy specification for your specific soil.

ThetaProbe Specification

Accuracy & range		*Calibration*	*Response & stabilisation*	*Environmental*	*Input & output*	*Dimensons, sampling volume & cabling*
± 0.01 $m^3.m^{-3}$ ± 0.02 $m^3.m^{-3}$	(1%): 0 to 40ºC (2%): 40 to 70ºC	After calibration to a specific soil type.	Response: <0.5 secs to 99% of change. 1 sec warm-up is advised. Full accuracy achieved within 5 secs.	Operates over -10 to +70ºC without damage. Buriable up to 5m deep in soil or water. Readings in frozen soils are not meaningful.	Requires 5 to15V DC at 20mA (typical). Minimum >5.5V with 100m cable Voltage output 0 to ~1V DC for 0 to 0.6 $m^3.m^{-3}$, almost linear. Compatible with most data loggers.	Rods 60mm x 3mm diameter. Overall length 207mm, diameter 40mm. Sampling volume: approx 60mm x 30mm diameter. 2m cable in ThetaKit
± 0.05 $m^3.m^{-3}$	(5%): 0 to 70ºC	Using "generalised" soil calibrations supplied.				
Accuracy figures apply over the range 0.05 to 0.6 m^3m^{-3}. Full reading range is 0 to 1 $m^3.m^{-3}$.						
Salinity errors from 0.0 to 250 $mS.m^{-1}$, <-0.0001 m^3m^{-3} change per $mS.m^{-1}$. Minimal change beyond 250 $mS.m^{-1}$. Can be calibrated up to 2000 $mS.m^{-1}$.						

Moisture Meter type HH2

Simple, versatile operation The ThetaKit includes the HH2 Moisture Meter which offers impressive functionality in a compact, hand-held unit, designed for field use. Readings are displayed on the LCD and can be stored to memory for later download to a PC. Up to 2100 time-stamped readings can be stored.

The unit can be operated with one hand, for convenience in the field.

Data is transferred to a PC using the RS-232 cable provided with each unit. The HH2Read Windows PC software provides a data import wizard for direct download into Excel or other PC spreadsheet packages, or into irrigation scheduling programs. Data can also be downloaded in comma-separated ASCII data file (.CSV) format.

Moisture Meter Specification

Soil moisture range	Zero to saturation. 0 – 1.5V on voltage range
Accuracy/Resolution	± (0.13% of mV reading ±1.0 mV). 1 mV resolution
Connection	1 x male 25-pin connector, used for RS232 communications and sensor connection
Sealing/environment	IP54 (Splashproof). Operating temp range 0ºC - 40ºC
Shock	Maintains functional specification after 1m drop onto concrete
EMC testing	Fully complies with European EMC regs. Tested to comply with EN 61326 class B
Size/weight	150 x 80 x 40mm, 450g
Battery life	Typically 6500 readings (9V PP3 alkaline cell)
Memory Capacity	Minimum 227 Typical 2186
Output	Soil Moisture content ($m^3.m^{-3}$ or % Vol), or water deficit (mm), or unconverted mV output
Carrying Case type HHCC1	Case dimensions: 340(w) x 85(d) x 280(h) mm (height includes handle).

Ordering Information
TK3-Basic: ThetaKit v3 - portable soil moisture measuring kit. Includes ThetaProbe ML2x/d-02 (2m cable), pack of 4 x spare stainless steel rods, Moisture Meter HH2, Insertion Kit ML-INK1, User manuals and carry case.

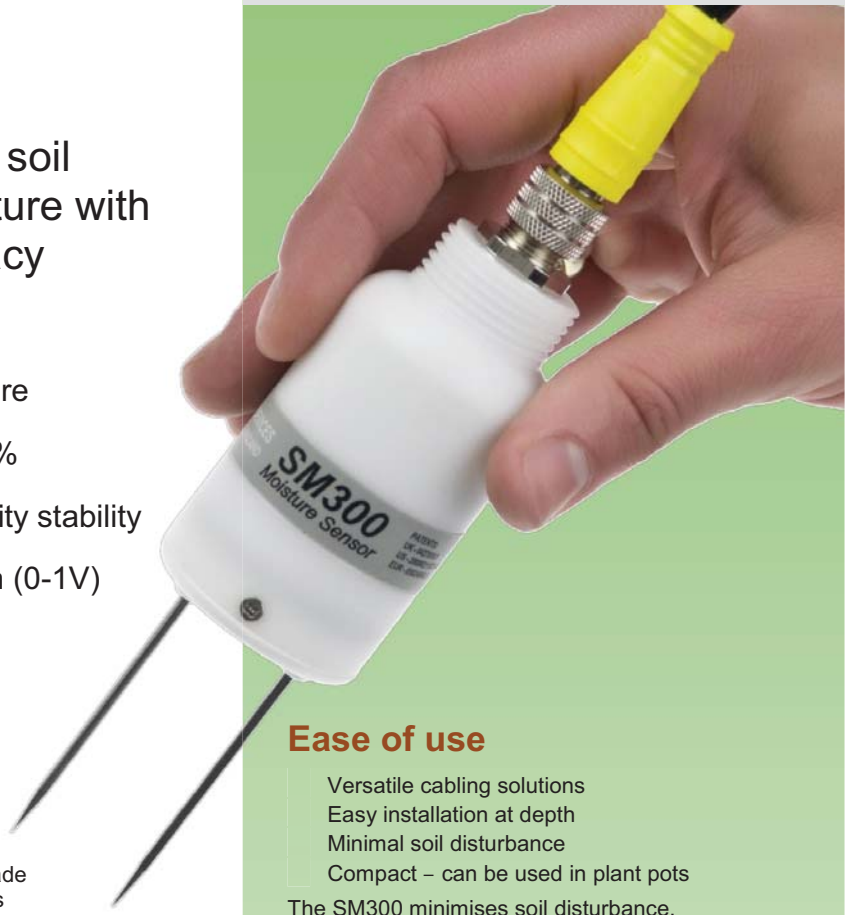
DELTA-T DEVICES

NEW

SM300
Soil Moisture Sensor
PRODUCT INFORMATION

The SM300 measures soil moisture and temperature with research grade accuracy

- Soil moisture and temperature
- Dependable accuracy ± 2.5%
- Good temperature and salinity stability
- Easy data logger connection (0-1V)

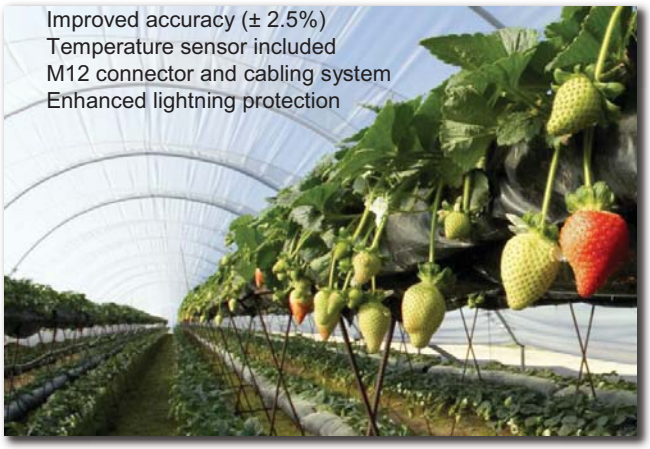


Research grade sensor

The market leading SM300 offers outstanding performance in normal and saline soil conditions, and is stable across wide ranges of temperature and salinity. Its construction uses industrial grade connectors and high specification materials throughout to produce a soil moisture sensor of outstanding quality. The built-in temperature sensor simplifies soil temperature measurement and achieves 0.5°C accuracy.

SM300 improvements

The SM300 incorporates the following improvements over the earlier SM200 design:



Ease of use

- Versatile cabling solutions
- Easy installation at depth
- Minimal soil disturbance
- Compact – can be used in plant pots

The SM300 minimises soil disturbance, preserving the original soil structure around the measurement rods. It is easy to insert and install whether at the soil surface or at depth. The SM300's circular shape facilitates installation in augered holes – extension tubes are available.

The SM300 is a dual-purpose probe – it can be used both with the HH2 hand-held Moisture Meter for instant moisture readings, or left in situ for data logging of moisture and temperature.

Calibration

The SM300 is provided with general calibrations for mineral and organic soils. A two-point soil specific calibration can be performed for greater accuracy if required.

Applications

- Soil science
- Agriculture & Horticulture research
- Irrigation

HOSKIN SCIENTIFIC

SM300 Specifications

	SM300	*Notes*
Soil Moisture Content		
Accuracy	± 0.025$m^3.m^{-3}$ (2.5%)	*Note [1]*
Measurement range	Full accuracy over 0 to 0.5$m^3.m^{-3}$	*Measures full range up to 1.0$m^3.m^{-3}$ with reduced accuracy*
Salinity range	50 to 1000$mS.m^{-1}$	*Salinity errors < 0.035$m^3.m^{-3}$ from 0 to 0.4$m^3.m^{-3}$*
Temperature range	Full accuracy over 0 to 60°C	*Moisture content readings in frozen soil are not meaningful*
Output	0 to 1.0V differential	*Corresponding to ~ 0 to 0.6$m^3.m^{-3}$ nominal*
Sample volume	~55 x 70mm diameter	*Sample volume extends to ~1 litre, but is weighted towards soil immediately surrounding the rods*
Soil Temperature	*SM300 must be fully buried for the sensor to accurately measure the temperature of the soil*	
Accuracy	± 0.5°C	*Excludes cable length errors, see User Manual for details [2]*
Measurement range	Full accuracy over 0 to 40°C	
Output	Resistance 5.8 to 28kΩ	*10k precision thermistor*
Power requirement	5 to 14V, ~18mA for 1s	
Environmental	IP68	*-20 to +60°C operating range*
Dimensions	143 x 40mm diameter	*See drawing below*
Weight	0.1kg	*Excluding cables*
Sensor calibration	Sensors are fully interchangeable	*Individual sensor calibrations not required*
Logger / Meter compatibility	GP1, DL6, DL2e and HH2	*HH2 does not record or display the soil temperature*

[1] Accuracy figures are quoted at an expanded uncertainty coverage level of k=2 and calculated using standard Monte Carlo techniques.
[2] Maximum cable lengths: 100m for GP1 and DL6 data loggers, 100m for DL2e water content measurement, 25m for DL2e temperature.

Ordering Information

Soil moisture sensor type SM300 with built-in temperature sensor and fitted with an M12 IP68 connector.
Cable must be ordered separately.

Cable options:

SMS sensor cable type SMSC/sw-05 5m cable, M12 to bare wire, suitable for connection to a GP1 or DL6 data logger.

SMS sensor cable type SMSC/lw-05 5m cable, M12 to bare wire with 100mm flying lead, suitable for connection to a DL2e.

5m extension cable type EXT/5W-05 5m cable, M12 to M12.

10m extension cable type EXT/5W-10.

25m extension cable type EXT/5W-25.

The EXT/5W-xx cables can be connected together to create custom lengths (see note [2] above) then fitted to an SMSC/sw-05 or SMSC/lw-05 cable for data logger connection.

1.5m cable SMS to HH2 type SMSC/d-HH2 1.5m cable, M12 to 25-way D-socket, suitable for connection to an HH2.

Accessories:

0.5m extension tube type ML/EX50

1.0m extension tube type ML/EX100

45mm Spiral Auger type SM-AUG-100 for installing SM300s at depth, length 1.2m.

Other soil moisture sensors

The **ML2x** provides exceptionally high-accuracy soil moisture readings (± 1%) within a well-defined soil volume.

The **PR2** is available in 4 and 6 sensor versions, enabling soil moisture profile readings to be taken down to 1m depth.

The **WET sensor** measures pore water EC as well as soil moisture and temperature directly within the growing media.

Delta-T can also supply a range of **tensiometers** including water-filled and dielectric models.

Data loggers / meters

Delta-T data loggers and accessories are compatible with the SM300 – please enquire about software compatibility and updates. The SM300 can be used as a portable moisture probe with the HH2 meter (the HH2 does not provide temperature indication from the SM300).

For these or other products, please request additional data sheets or see www.delta-t.co.uk.

Water Content
Electrical Conductivity
Temperature

COST-EFFECTIVE SOLUTIONS FOR HORTICULTURALISTS AND GROWERS

Moisture and nutrient status in the root zone

The WET Sensor from Delta-T Devices is essential equipment when accurate measurement in soil and substrates is vital to your business

The Delta-T WET Sensor has crucial applications in precision horticulture and soil science research, and is usable in both soils and growing substrates. It is exceptional in its ability to measure pore water conductivity (EC_p), the EC of the water that is available to the plant.

Readout and data storage are carried out with the HH2 Moisture Meter

Water Content
Electrical Conductivity
Temperature

DELTA-T DEVICES
PROVEN APPLICATIONS
IN PRECISION
HORTICULTURE
AND SOIL SCIENCE

The Delta-T WET Sensor

The Applications

The Delta-T WET Sensor is essential for testing the following…

Fertigation and hydroponics

Where plants are grown in artificial substrates, nutrients are routinely supplied in irrigation water - "fertigation".
Nutrient levels are controlled by monitoring the water content and conductivity (EC) and adjusting the injection of liquid fertiliser into the irrigation water. The Delta-T WET Sensor excels in monitoring this crucial information.

Soil salinity

If the irrigation water is recycled or abstracted from rivers with high levels of dissolved salts, over time there can be a build-up of soil salinity. Soil salinisation will eventually reduce crop yields. The WET Sensor is fast and efficient for sampling soil salinity, ensuring that farmers have the essential information they need to take remedial action as quickly as possible.

Container-grown shrubs and trees

Nutrients are sometimes provided by fertigation but are often provided by Controlled Release Fertilisers. The rate at which these are taken up depends on the weather conditions. The Delta-T WET Sensor can be used to measure EC within the growing media, removing much of the guesswork from this procedure.

The Advantages

The WET Sensor combines a number of features to make it indispensable in horticulture…

Saves time and money

The WET Sensor takes a complete reading in ~5 seconds – so you can monitor the growing conditions of hundreds of plants in a day. It replaces expensive lab analysis and ensures your crops are grown under optimal conditions.

Absolute accuracy

Water content ± 3%
Pore water EC ± 0.1mS.cm^{-1} (varies with water content)
Temperature ± 1.0°C

Research grade sensor

The WET Sensor has been used in research for over 15 years. Innovative ASIC-based design and 3-parameter measurement make it an effective solution to the problem of monitoring growing conditions in competitive areas of horticulture and agriculture.

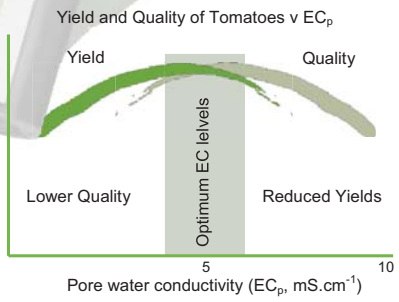
Simple operation

Insert the WET Sensor, press [Read] and scroll down [⊠]:
Water Content 65%
Pore water EC 4.1 mS.cm^{-1}
Temperature 27.2°C
Detailed reading set-up is available but rarely needed.

Specialist calibrations

The WET Sensor is supplied with default calibrations for generic mineral, organic, sand and clay soils. Specialist substrate calibrations are available as a set for a variety of horticultural media - see ordering information.

Ordering information	
WET-2-K1	WET Kit including WET-2/d, HH2 Moisture Meter, manuals and carrying case.
WET-2-K4	As WET-2-K1 kit plus WET-GH-1 substrate calibrations upgrade.
WET-2/d	Sensor with 1.5m cable and 25-way D-socket for use with HH2 Moisture Meter.
WET-GH-1	Specialist calibrations for horticultural substrates: peat-based potting mix, greenhouse "mineral" soils and coir.
WET-ST1	Specialist calibrations for Stonewool.



The WET Kit

5TE Soil Moisture, Temperature and EC

Model: E-240-40557

Soil Moisture, Temperature, and Electrical Conductivity

Want to manage salts in your system? The 5TE lets you monitor bulk electrical conductivity(EC) in addition to volumetric water content (VWC) and temperature in soil.

Monitor Salt Levels

In water limited areas, salt management is a serious concern. In these areas, monitoring salt levels can be as important as monitoring soil moisture. The 5TE allows you to measure salt levels through bulk electrical conductivity.

EC measurements require good contact between the stainless steel and the soil. Because of large air spaces in potting soil and soil-less media, the 5TE cannot be used accurately in potting soils or soil-less substrates. Contact Decagon directly for other options to measure the EC of soilless substrate or rockwool.

Engineered for Accuracy

All three measurements (water content, temperature, and EC) are made independantly with the 5TE. Like all ECH_2O sensors, the 5TE determines volumetric water content (VWC) by measuring the dielectric constant of the media using capacitance/frequency domain technology. The sensor uses a 70 MHz frequency, which minimizes salinity and textural effects, making the 5TE accurate in almost any soil. The 5TE measures temperature with an onboard thermistor and electrical conductivity using a stainless steel electrode array. VWC in mineral soils is calculated using the Topp equation; other calibrations provided on request. Temperature and electrical conductivity are factory calibrated for all soil types.

Easy Installation

The 5TE's small size makes it easy to install--perfect in field installations. This robust probe can be pushed directly into undisturbed soil to ensure good accuracy.

Integrate with Campbell Scientific Data Loggers

Serial and SDI-12 communication options mean easy integration with systems run by other data loggers (including Campbell Scientific).

Reasons to pick the 5TE:

- If you need to measure VWC, EC, and temperature
- If you are managing salts in your system
- If you want to use SDI-12

ACCURACY	Apparent dielectric Permittivity (ε_a): $\pm 1\varepsilon_a$ (unitless) from 1-40 (soil range), ±15% from 40-80 VWC: • Using Topp equation: $\pm 0.03 m^3/m^3$ (±3% VWC) typical in mineral soils that have solution electrical conductivity <10 dS/m • Using medium specific calibration, $\pm 0.01\text{-}0.02 m^3/m^3$ (±1-2% VWC) in any porous medium Electrical Conductivity (EC): ±10% from 0 to 7 dS/m, user calibration required above 7 dS/m Temperature: ±1°C
RESOLUTION	ε_a: $0.1\varepsilon_a$ (unitless) from 1-20, $<0.75\varepsilon_a$ (unitless) from 20-80 VWC: $0.0008 m^3/m^3$ (0.08% VWC) from 0 to 50% VWC EC: 0.01 dS/m from 0 to 7 dS/m, 0.05 dS/m from 7 to 23.1 dS/m Temperature: 0.1°C
RANGE	ε_a: 1 (air) to 80 (water) EC: 0-23 dS/m (bulk) Temperature: -40-50°C
MEASUREMENT SPEED	150mS
SENSOR TYPE	VWC: Frequency domain EC: Two probe design Temperature: Thermistor
OUTPUT	Serial TTL, 3.6 Volt Levels or SDI-12 (contact Decagon for information on SDI-12 mode)
OPERATING ENVIRONMENT	-40°C to 50°C
POWER	3.6-15 VDC, 0.3mA quiescent, 10mA during 150ms measurement
CABLE LENGTH	5m, custom cable lengths available upon request
CABLE CONNECTOR TYPES	3.5mm "stereo" plug or stripped and tinned lead wires (3)
SENSOR DIMENSIONS	10 x 3.2 x 0.7cm
DATA LOGGER COMPATIBILITY (NOT EXCLUSIVE)	Decagon: Em50, Em50R, ProCheck Campbell Scientific: CR200X - series, CR800/CR850, CR1000, CR3000, CR9000X Other: Any data acquisition system capable of 3.6-15V excitation and serial or SDI-12 communication
WARRANTY	One year, parts and labor

PRELIMINARY DATASHEET

Soil Moisture Meter

Integrated 8" (20cm) Heavy Duty Probe

Monitor moisture in soil with the built-in stainless-steel moisture probe

Features:

- Soil moisture content measurement from 0 to 50%
- Easy one-hand operation
- Min/Max records minimum and maximum moisture readings
- Data hold to freeze reading on display
- Water resistant housing
- Replaceable Heavy Duty Moisture Probe (MO750-P)
- Complete with 4 x AAA batteries and sensor cap

Specifications	
Sensor Type	Integrated Contact Probe
Moisture Content	0 to 50%
Max Resolution	0.1%
Dimensions	14.7 x 1.6 x 1.6" (374 x 40 x 40mm)
Weight	9.4oz (267g)

Check the moisture of soil content to insure healthy plant growth

Ordering Information:

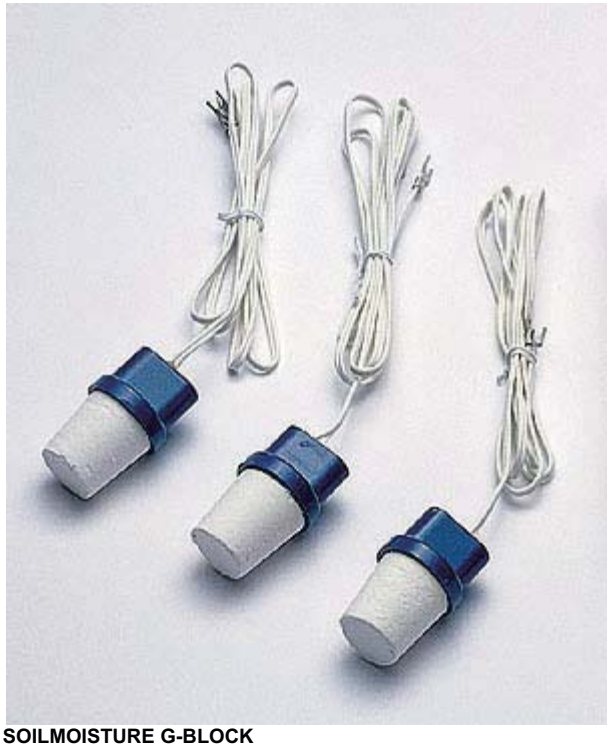
MO750.....Soil Moisture Meter
MO750-P.....Replacement Moisture Probe for MO750

CE

Gypsum Blocks

Model: E-127-5201F1

Product Number: 5201F1 Series
SOILMOISTURE G-BLOCK



SOILMOISTURE G-BLOCK

Weight: .06-.42 Lbs (.03-.19 kgs)

Dimensions:

G-Blocks are the most cost effective method of tracking your water and subsurface moisture by electronic means. The blocks have been designed to provide a largest resistance range possible at the moist end of use where sensitive plants need monitoring. The large gypsum content of the block provides months of buffering soil solutions to assure that your really reading water content and not salinity or fertilizers. They are easy to install and simple to read and provide a reliable method for subsurface moisture monitoring. The Model 5201F1 Gypsum Blocks feature a slim, 7/8" (2.2 cm) diameter design and come in a variety of lead lengths. Once buried, depending on soil type and conditions, the blocks have a life span of 2-5 years. Available with 3, 6, 9, 15, 25 and 50 foot leads.

Select options:

Part number	Description
5201F1L03	GYPSUM BLOCK, 3 foot leads
5201F1L06	GYPSUM BLOCK, 6 foot leads
5201F1L09	GYPSUM BLOCK, 9 foot leads
5201F1L15	GYPSUM BLOCK, 15 foot leads
5201F1L25	GYPSUM BLOCK, 25 foot leads
5201F1L50	GYPSUM BLOCK, 50 foot leads

Quick Draw Tensiometer with Gauge
Model: E-127-2900F1...

The Model 2900F1 Quick Draw Tensiometer is designed for portable field use. It responds quickly and equilibrates rapidly with the tension in the soil, providing measurements within a few minutes. The Soil Coring Tool is first used to core an access hole to the desired depth of measurement. The tensiometer is then inserted into the access hole and the ceramic sensing tip is placed in contact with the soil. The Null Knob can be used to reach equilibrium and provide a measurement more rapidly. The coring tool, cleaning tool, and tensiometer are then returned to the carrying case for transportation and storage. An accessory kit, which contains a replacement ceramic sensing tip, O-rings, screwdriver, and Allen wrench, is included. Gauge shown to display face readout, comes ready for vertical viewing.

Jet Fill Tensiometers
Model: E-127-2725ARL

A tensiometer measures the force with which water is held in the soil by the soil particles. This force, referred to as soil suction, tension, or potential, indicates how tightly the water is bound in the soil, and how much energy must be exerted by plant roots to remove and use the water. The basic components of a tensiometer include a porous ceramic cup, a plastic body tube, and a vacuum gauge. The ceramic cup is placed in good hydraulic contact with the soil and allows transfer of water into and out of the tensiometer body according to the tension in the soil. The vacuum inside the tensiometer body equilibrates with the soil water tension, and the dial gauge provides a direct readout of the tension.

The Model 2725AR Jet Fill Tensiometer features the patented Jet Fill reservoir for push-button convenience and minimization of soil disturbance when servicing is required. Unique modular construction allows for easy replacement of the porous ceramic cup and dial gauge and adaptation of extensions for flexibility and variety in use. Series 0240 Insertion Tools can be used to core a hole to accept these units.

Tensiometer with Gauge
Model: E-127-2710ARL

A tensiometer measures the force with which water is held in the soil by the soil particles. This force, referred to as soil suction, tension, or potential, indicates how tightly the water is bound in the soil, and how much energy must be exerted by plant roots to remove and use the water. The basic components of a tensiometer include a porous ceramic cup, a plastic body tube, and a vacuum gauge. The ceramic cup is placed in good hydraulic contact with the soil and allows transfer of water into and out of the tensiometer body according to the tension in the soil. The vacuum inside the tensiometer body equilibrates with the soil water tension, and the dial gauge provides a direct readout of the tension.

The Model 2710AR-L Tensiometer is a simple, versatile, and inexpensive instrument which provides a direct measurement of soil water tension. The modular design allows easy replacement of the ceramic cup and dial gauge, and addition of extension tubes and the Service Cap. The tensiometer is available in a variety of lengths, ranging from 6 inches (15 cm) to 60 inches (1.5 m). Series 0240 Insertion Tools can be used for coring a hole in the soil to accept these units. The Model 2710K1 Service Kit, available separately, is used to refill and maintain the tensiometer.

An additional accessory available for all tensiometers is the "low tension" dialgauge. This gauge has a scale division from 0 to 50 centibars. This will allow a better and more accurate reading of the soil suction upto 50 centibars. (2060FG6)

T4 Field tensiometer

Standard field tensiometer. Only the ceramic cup is filled with water to improve accuracy and offer year-round operation. Optionally with external refilling: The model T4e with external refilling can be refilled or emptied without removing it from the soil.

T5 Laboratory tensiometer

Quick-response mini-tensiometer for measuring water potential in small spaces like soil columns, potted plants, and laboratory water flow experiments. Can be used to make spot measurements in the field if care is used.

T8 External refilling field tensiometer

Field tensiometer's water level indicator tells you when to refill. Also measures temperature and has an external refilling option. more

TS1 Smart tensiometer

The world's first "smart tensiometer." Designed to be installed in the field and left alone. The TS1 logs water potential data, self-refills using soil moisture, monitors temperature, and self-empties when the temperature nears freezing to avoid damage.

MPS-1 Water Potential Sensor
Model: E-240-MPS-1

The new MPS-1 Water Potential Sensor allows you to have a large range of continuous soil water potential measurements without calibration. Integrating a high performance ceramic with the new dielectric circuitry of the EC-5, the MPS-1 collects accurate water potential measurements while never needing any user maintenance. In the field, the MPS-1 can be quickly installed down-hole by inserting the sensor and packing wet soil around it. Measuring and recording data is also simple as it can be easily plugged into an Em50 port or any other capable datalogger. A factory calibration allows the sensor to read out in soil water potential, regardless of the soil type it is in, while the high frequency dielectric circuit minimizes soil electrical conductivity sensitivity.

Dielectric Water Potential Sensor Applications:

- Water potential monitoring in vadoze zone.
- Crop Stress.
- Waste water drainage studies.
- Irrigation monitoring and control.
- Plant water availability.
- Soil stress monitoring.

WP4 & WP4-T Dewpoint Meters
Model: E-240-40503

Fast, Accurate Water Potential Measurements
Use the WP4 to measure water potential in 5 to 10 minutes. Range: 0 to -300 MPa with a resolution of 0.1 MPa.

Easy Operation
The WP4 is a bench-top instrument with a lexan sample drawer. To make a reading, set a cup in the chamber and close and latch the drawer.
Soil suction data can be stored internally or transferred to a computer or printer with the included serial RS232 interface cable.

Sample Size
Sample cups are 4 cm in diameter and 1 cm tall. They have a 15 ml capacity, but to protect the sensor from contamination we recommend that you fill them only half full.

No-Hassle Cleaning and Calibration
The WP4 sensor is easy to clean and durable. The instrument can be calibrated using saturated salt solutions (mix your own or order single-sample sized vials of standards on the accessories tab).

Chilled Mirror Dewpoint Technique
The WP4 measures water potential by determining the relative humidity of the air above a sample in a closed chamber (an AOAC-approved method). At temperature equilibrium, relative humidity is a direct measurement of water potential.

Penetrologger - Compaction
Model: E-365-06.15.SA

The resistance to penetration is a means of determining the ground load-bearing capacity, and the ease with which roots will grow through the ground (important when agricultural, rural- and civil engineering techniques are involved). The resistance to penetration is a mechanical characteristic that, given a certain texture, depends on changing parameters such as degree of humidity, density and the strength of the connection between mineral particles. Measuring the resistance to penetration of the soil in a great number of measurements is best executed applying an electronic penetrometer together with a datalogger, allowing for immediate storage and processing of the data in the datalogger. To this purpose Eijkelkamp developed the penetrologger: An electronic penetrometer with a built-in datalogger for storage and processing of a great number of measuring data (1500 measurements).

06.15 Penetrologger, standard set for measurement to a depth of 80 cm

The penetrologger is a versatile instrument for in situ measurement of the resistance to penetration of the soil.
The cone is screwed on the probing rod, which is connected with a quick coupling to the force sensor on the penetrologger. Now the cone is pushed slowly and regularly into the soil. The depth reference plate, which is on the soil surface, reflects the signals of the ultrasonic sensor, which results in a very accurate depth measurement. The depth reference plate is also used to reflect the signals which are used to control the penetration speed. The measured resistance to penetration and the GPS coordinates are stored in the internal logger of the penetrologger. Depending on the application and the expected resistance to penetration, various cones can be connected to the probing rods. Optional is the possibility of soil moisture measurement with an external soil moisture sensor.

Applications

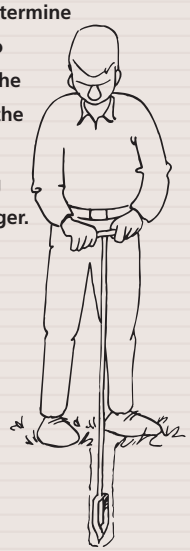
The penetrologger can be applied in the agricultural- as well as in the civil engineering sector:
· general soil science research;
· foundation technology;
· checking whether or not the soil is suitable for agricultural;
· research into (expected) growing conditions for plants;
· the detection of compacted (possibly impermeable) sub-soil layers;
· research into poor growing conditions of for instance trees in the city or in parks;
· checking artificially-made compactions;
· checking the suitability of soils for carrying vehicles or pedestrians.

HAND PENETROMETER EIJKELKAMP

P1.50

The penetrometer is pushed perpendicular into the soil at a speed of approximately 2 cm per sec. applying equal pressure on both grips.

To be able to determine the resistance to penetration of the lower layers in the soil the hole is pre-drilled using the Edelman auger.



Penetrometers are used to determine the resistance to penetration (bearing capacity) of a soil. The Eijkelkamp penetrometer is delivered in two different sets:

06.01.SA Hand penetrometer Eijkelkamp, set to a depth of 1 meter

06.01.SB Hand penetrometer Eijkelkamp, set to a depth of 3 meter

Both sets can be used for probing to a dept of between 1 and 3 meter. Both sets contain various cones, probing- and extension rods, a measuring instrument with a pressure gauge, tool set, a cone check, a calibration certificate and an instruction manual.

The measuring range of the pressure gauge is 10000 kN/m^2 (=10000 kPa).
The scale range runs from 0 up to 1.0 kPa. The accuracy is +/– 8% in the advised measuring range. The sets have been packed in compact aluminium carrying cases.

to execute research of a soil profile as well, or to penetrate a tougher layer in the soil.
The auger is also applied to drill-out the probing hole to avoid adhesion between the probing rods and the shaft wall.

Basically the penetrometer consists of a measuring instrument, a probing rod and a cone.

The device is pushed perpendicular into the soil by applying equal pressure on both grips. Jerking pushes yields values which are too high and which do not represent the soil.

The resistance measured by the cone can be read from the pressure gauge as indicated by the black pointer. The maximum resistance recorded during measurement is indicated by the red dragging pointer.

Hand penetrometer Eijkelkamp (SB)

BENEFITS

06.01 Hand penetrometer

- Accurate hydraulic reading dial
- Perfect for agronomists and contractors
- Can be operated with full body weight
- Dial equiped with drag pointer
- Comes with all rods and cones 1-5 cm2
- Set B for depths up till 3 m
- Cone check to check quality of cones
- Auger to remove hard layers
- Very simple operation

HAND PENETROMETER EIJKELKAMP

P1.50

The resistance to penetration (kPa/cm²) of the soil can now be determined by dividing the reading value by the surface of the cone. The value of the resistance to penetration to be expected determines the surface of the cone to be used.
For high values the small cone is used and for low values the larger cones are applied. The larger the cone the more accurate the value of the resistance to penetration can be determined.

Applications

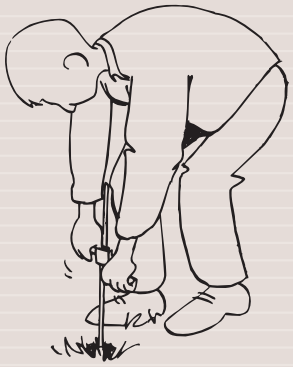
Because of their depth range the devices can be applied for the following:

- General soil research.
- Basic advise for foundations.
- Checking artificial compaction of the soil.
- Research of the growing circumstances (to be expected) of plants in the soil.
- Tracing compacted layers in the soil.

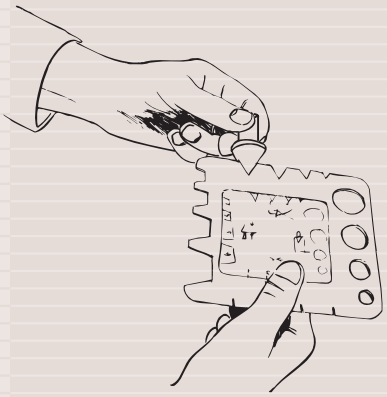
Advantages

- Compact and complete.
- Easy to operate.
- Little maintenance.

Applying the pull/push handle the extension- and probing rods can be extracted from the soil.



The cone check is used to inspect the wear of the cones.



Measuring instrument with manometer

Cones and probing rods

Cone check

Hand penetrometer Eijkelkamp (SA)

Soil Penetrometer, Pocket Type
Model: G-118-H-4200

For use by field personnel to check visual classification of soils. Verifies whether excavation side walls require shoring, based on OSHA cohesive soils classifications. Indicates consistency, shear strength, and approximate unconfined shear strength. Direct-reading scale—in tons/sq ft, or kg/sq cm—corresponds to equivalent unconfined compressive strength. Range: 0 to 4.5 tons. High quality construction. Includes belt-loop style carrying case and operating instructions. Should not replace laboratory testing or field analysis, or be used to produce foundation design data.

Adapter foot (G-118-H-4200-F) is recommended when testing extremely low strength cohesive soils. 1" (25mm) dia. foot, compared to the 1/4" (6.35mm) penetrometer piston, increases the effective area measured by 16 times. Divide by 16 to obtain correct unconfined compressive strength when the reading in tons per square foot or kilograms per square centimeter is on the low-load side.

Aggregate Stability - Wet Sieving Apparatus
Model: E-365-08.13

The aggregate stability of a soil is the resistance of soil structure against mechanical or physico-chemical destructive forces. Soil structure is one of the main factors controlling plant growth by its influence on root penetration, soil temperature and gas diffusion, water transport and seedling emergence and therefore it is an important soil characteristic for farmers.

Wet sieving apparatus, complete set to determine the aggregate stability of soil.

The wet sieving apparatus is used to determine the above mentioned aggregate stability. The wet aggregate stability is determined on the principle that unstable aggregates will break down more easily than stable aggregates when immerged into water. To determine the stability, 8 sieves are filled with a certain amount of soil aggregates. These sieves are placed in a can filled with water, which will move up and downward for a fixed time. Unstable aggregates will fall apart and pass through the sieve and are collected in the water-filled can underneath the sieve. The testing procedure results in an index for aggregate stability.

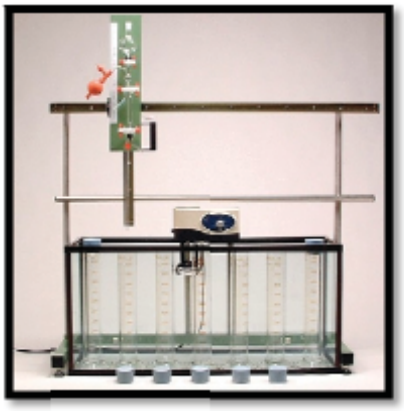
Applications
Applications of the wet sieving apparatus are the fields of agriculture and land conservation (research on soil erosion, land degradation / conservation, salinization, agriculture, sustainable agriculture). Determining aggregate stability will give information on the sensitivity of soils to water and wind erosion, which might be prevented e.g. by mulching the soil surface. Information on soil aggregate stability can also improve tillage programs, adapted to the specific soil type and crop demands.

Calcimeter
Model: E-365-08.53

The calcimeter by Eijkelkamp is suitable for the simultaneous determination of the carbonate content in 5 samples. Where possible the vulnerable glass was replaced by synthetic materials. Because hydrolchloric acid is used, a stable and ergonomic design was chosen. Per reaction approximately one hour is required. Carbonates that are hard to dissolve, such as seashells, take more reaction time.

The quantity of sample needed is determined beforehand by treating a part of the sample with hydrochloric acid on a watch glass. The carbonate content is estimated on the basis of the extend and the period of bubbling. Based on this estimate the quantity of sample for the analysis is determined.

Pipette Apparatus
Model: E-365-08.16.SA



The particle-size distribution is one of the most important physical qualities of a soil. The division of soils (soil classification) is primarily based on particle-size distribution. When accurately determining the particle size in samples, in addition to the determination using sieves, other methods will need to be applied.

A simple method for the determination of the particle size is the pipette method. After carbonates, organic substances and possible iron oxide have been removed the pipette method is used to determine the fractions of particles smaller then 38 ìm. The method is based on the difference in sedimentation speed between small and large soil particles. The sedimentation of the particles is the result of two opposing forces: gravity and friction resulting from movement in a fluid medium. In the pipette method a sample is pipetted at different times and different depth of the suspension of the sample in a measuring cylinder. Time and depth are determined applying the Law of Stokes.
The pipetted suspension is condensed and dried and weighing determines the mass ratio of the pipetted fraction.

Pipette apparatus, table model in accordance with NEN 5753

Using the basic set the fractions of 7 samples can be determined simultaneously. The pipette apparatus can be placed on a laboratory table.

Air Pycnometer
Model: E-365-08.60

The pycnometer is applied where there is an interest in knowing the specific weight.

•soil research, for instance the determination of the porosity of soil samples. It is recommended to use soil sampling rings with a 100 cc contents when taking undisturbed soil samples;
•powder- and granulate research in the pharmaceutical industry;
•measuring the pore volume of tarmac (road construction) or clay and bricks (brickworks);
•volume determinations of seeds, coffee beans, legumes, etc. in the food industry.

Kit for Direct Measurement of Soil Activity and Solutions Conductivity

HI 993310 is an instrument that has been specifically designed to address the question of correct and rapid measurement of conductivity in soil and liquids. It is supplied complete with two probes, **HI 76305** with a stainless steel, conic tip for direct soil measurement, and **HI 76304** for fertilizer enriched solutions.

HI 993310 measures both the soil conductivity in EC (mS/cm) as well as salt activity in grams per liter. The different scales can be selected through two keys on the front mask and two separate LED lights indicate which parameter is being tested. In addition, **HI 993310** is equipped with an alarm LED that automatically turns on if the soil is too dry, or nutritive substances such as potassium or nitrogen are lacking. In the former case, demineralized water is to be added to the soil prior to proceeding with further tests. Direct soil measurement is facilitated by the small diameter, stainless steel, pointed **HI 76305** probe. Once inserted into the ground, the user just needs to wait until the meter displays the value read by the auger-like probe.

Specifications

	HI 993310
Range EC	0.00 to 19.99 mS/cm
activity	0.00 to 1.00
Resolution EC	0.01 mS/cm
activity	0.01
Accuracy (@ 20°C/68°F)	±2% F.S. (0 to 15.00 mS/cm; excluding probe error)
Calibration	manual, 1 point
Temperature Compensation	automatic, 0 to 50°C (32 to 122°F), ß=2%/°C
Probes	**HI 76305**, for direct soil measurements, with stainless steel body, conic tip, built-in temperature sensor and 1 m (3.3') cable (included) **HI 76304**, for EC measurements in solution, with plastic body, built-in temperature sensor and 1 m (3.3') cable (included)
Battery Type / Life	1 x 9V / approx. 100 hours of continuous use
Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
Dimensions	185 x 82 x 52 mm (7.3 x 3.2 x 2.0")
Weight	275 g (9.7 oz.)

Accessories

HI 76305	Stainless steel probe for direct soil measurement
HI 76304	EC probe for measurement of solution and soil sample
HI 7030L	12880 µS/cm calibration solution, 500 mL bottle
HI 7031L	1413 µS/cm calibration solution, 500 mL bottle
HI 7051M	Soil preparation solution
HI 721319	Ground auger
HI 710009	Shockproof rubber boot, blue
HI 710010	Shockproof rubber boot, orange
HI 710002	Soft carrying case
HI 721313	Rugged carrying case

Ordering Information

HI 993310 is supplied complete with **HI 76304** EC probe for solutions, **HI 76305** stainless steel probe for direct soil measurements, **HI 7051M** soil preparation solution, **HI 721319** ground auger, battery, rugged carrying case and instructions.

For a complete range of calibration, cleaning and maintenance solutions, see section F. For accessories, see section U.

LaMotte pH Tracer Meter

* Provided with 4, 7, and 10 pH buffer tablets
* Range: 0.00 to 14.00 pH/0.01 pH
* Temp: 23° to 194°F (–5° to 90° C)
* Resolution: 0.01 pH
* Accuracy: ±0.01 pH
* Rugged flat surface electrode will alert user when it's time to "RENEW"
* A "CAL" indicator shows when to recalibrate and user can select a 1, 2, or 3 point calibration
* Includes Automatic Temperature Compensation and displays temperature while showing pH result
* Optional interchangeable probes for Total Chlorine (code 1732) and ORP (code 1734) measurements in water.
* Auto-off after 10 minutes
* Power: Four LR-44 batteries

Hoskin Scientific Ltd

IQ 150 pH Meter

Fast, easy and accurate soil pH measurement tool!

A direct ISFET pH probe with a full year warranty. The fully redesigned probe extends a full 6 inches in length and has a "New" narrower point (3/16th in) which is great for small plug trays and causes less root disturbance. The Improved sensor design allows for sampling on the side and prolongs probe life.

The IQ 150 permits instant, accurate measurement of pH in soil media as well as water or nutrient solutions. Use this portable meter for field work, food testing, soil testing, industrial applications and educational use. Probe to measure pH in growing media right on the spot, without conducting tedious soil sampling and preparation.

The IQ 150's tough, stainless steel probe stores dry. A durable ISFET silicon chip sensor eliminates problems associated with glass bulb sensors and accurately measures even a single drop . The ultra-rugged meter is armored in a water-resistant rubber holster and is engineered to withstand a 10-foot drop onto concrete.

Features include recognition of 7 buffers, 0.1 or 0.01 pH resolution, automatic or manual temperature compensation, and one-point or two- point calibration. Includes meter, probe, 9-volt battery and user's manual. Does not include calibration standards.

SPECIFICATIONS FOR IQ 150 pH METER
pH Sensor: Stainless steel probe with silicon chip pH sensor
Range: pH – 0 to 14; mV – ±1999; Temp – 0° to 100°C
Calibration: One or two point, automatic
Accuracy/Repeatability: ±0.01 pH ± 1 digit
Auto Temp. Compensation: 0° to 100°C

Model STH Series - Combination Soil Outfits

This line of combination soil analysis outfits offers the finest visual color matching system available to today's agronomist. Technically advanced reagent systems and unique extraction procedures based on the Mehlich I extraction provide fast, simple and extremely accurate soil testing.

The Model STH Combination Soil Outfits have offered simplified methods for determination of available nutrients found in agricultural soils for over forty years.

Since the original introduction of the STH series, based on Morgan soil test methods, reagent systems have been updated constantly with new advancements in modern chemistry. A series of rapid, accurate chemical tests use standardized reagents to produce color reactions measured against laminated color charts.

All STH outfits are furnished in lightweight carrying cases with components securely mounted in removable foam trays. This format provides flexibility for the in-house specialist who also wants to make quick problem determinations in the field.

Colorimetric test methods are used for most test factors. Tests for calcium, sulfate and chlorides are based on turbidity measurements. Potassium analysis also employs a turbidity measurement, using a unique reading device designed in LaMotte laboratories to read directly in pounds per acre. A single extraction procedure, using Morgan Universal Extraction Solution, provides the liquid soil extract for all the nutrient tests with the exception of chloride, which is extracted with demineralized water. The Humus Screening Test, performed on a soil sample-demineralized water suspension, employs five color standards for rapid measurement of humus content of the soil.

Soil pH is determined colorimetrically, using a series of pH indicators and color charts covering the range of pH 3.8 to 9.6. The STH outfits also include simplified procedures for screening nitrates, phosphorus, and potassium in plant tissues. Complete reagent refill packages are available for each STH outfit.

Each kit includes complete instructions, a soil management handbook and a pad of soil analysis report forms. The LaMotte Soil Handbook contains general information on interpretation of test results for determination of lime and fertilizer requirements.

Item Description	Order Code
Macronutrients & pH Model STH-4	5029
Reagent Refill	R-5029
Macronutrients, pH, Humus, Calcium, & Magnesium Model STH-7	5061
Reagent Refill	R-5061
Macronutrients, pH, & Humus Model STH-5	5007
Reagent Refill	R-5007
Macronutrients, Micronutrients, & pH Model STH-14	5010-01
Reagent Refill	R-5010-01
Phosphorus Auxiliary package	5090

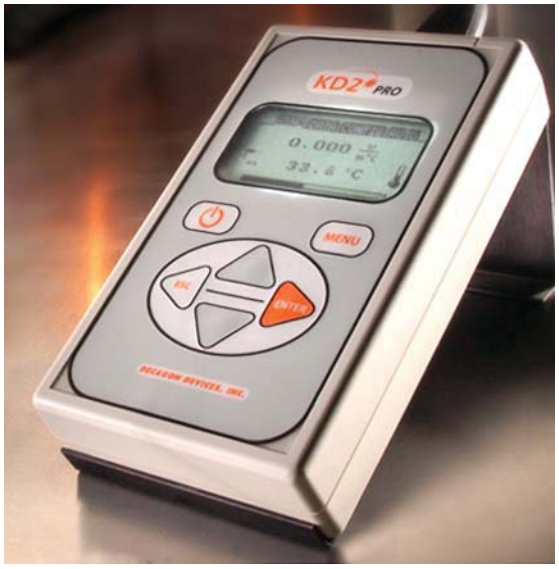
Model EL - Garden Kit

A simple test kit for soil science education or garden analysis. Rapid test procedures, diagrammed instructions, and laminated color charts are used to measure concentrations of nitrogen, phosphorus, potassium (15 tests each), and soil pH (30 tests). The Garden Guide manual and LaMotte Soil Handbook are included to interpret test results and give lime and fertilizer recommendations.

Item Description	Order Code
Model EL Garden Kit	5679
Reagent Refill	R-5679

KD2 Pro Thermal Properties Analyzer
Model: E-240-40348

The KD2 Pro is a fully portable field and lab thermal properties analyzer. It uses the transient line heat source method to measure thermal diffusivity, specific heat (heat capacity), thermal conductivity, and thermal resistivity. Sophisticated data analysis is based on 30+ years of research experience on heat and mass transfer in soils and other porous materials.



Excellent Accuracy
The compact KD2 Pro controller is much more than a simple readout for time and temperature. A proprietary algorithm fits time and temperature data with exponential integral functions using a nonlinear least squares method. This full mathematical solution delivers thermal resistivity to within ±10%.

Corrects for Temperature Drift
Temperature changes of a thousandth of a degree per second--the sun warming the soil, for example, or someone walking into the lab-- destroy the accuracy of thermal properties calculations. Unlike other thermal needle systems, the KD2 Pro corrects for linear temperature drift that can account for large errors.

Complies with ASTM, IEEE, SSSA Standards
For more information, see the support tab and the application note "The KD2 Thermal Properties Analyzer vs. Published Standards."

Th3 Soil Temperature Profile Probe
Model: I-802-Th3

Typical Applications

- Measure the temperature profile in soils in six fixed depths

Advantages

- Get a temperature profile with only one probe
- 6 standard analogue signals 0 ... 1 V
- Punctual temperature pick-up
- Minimized soil disturbance
- No influence of ambient temperature
- Punctiform temperature pick-up
- Excellent thermal contact through thin-walled stainless/steel rings
- Robust and maintenance free
- GRP tube, extremely rugged, flexible, dimensionally stable, low water absorption, very low creep behavior

Limitations

- Not designed for spot measurements
- Only for data logger connection
- The depths are fix and cannot be changed

HyProp System
Evaporation Method According to Schindler
Model: I-802-HYPROP

Advantages

- Easy and flexible handling
- Usage of intact standard sampling rings without perforation
- Tensiometer shafts are installed into the sample from the bottom side
- Low expenditure of time and costs
- Suitable for mobile applications
- High-quality results for the water retention curve especially in the range close to saturation
- The hydraulic functions are consistently proved by numerous readings
- T5x Tensiometers may measure beyond 250 kPa due to boiling retardation
- The mathematical functions are profoundly adapted
- Simultaneous measurement of water retention curve and hydraulic conductivity
- Suitable for all soils (provided Tensiometers can be installed)
- No special requirements for the ambient conditions. Only the evaporation conditions should remain more or less constant during a measurement
- An existing scale with serial port can be connected to the system
- Extendable to up to 20 assemblies for one scale

Technical Information

Sensor unit	
Measuring range for each Tensiometer	+20 hPa ... -1200 hPa / -2500 hPa
Resolution	0,01 hPa
Accuracy	1,5 hPa (0hPa ... 800 hPa)
Case/Dimensions without soilsample ring	PA66GFK, h=60 mm, 80 mm
Interface	RS485 tensioLINK
Laboratory scale (optional)	
Measuring range	0 ... 2,5kg
Resolution	0,01g
Accuracy	0,1g
Interface	RS232

SOIL WATER RETENTION EQUIPMENT

Pressure Membrane Extractors

1000 PRESSURE MEMBRANE EXTRACTOR 15 BAR

Water retention curves from shrink / swell soils – 15 Bars

A common problem in soils research is determining water retention curves for various soil types. The problem is that many soils around the world that provide excellent plant growth potentials are "shrink -swell" soils. This applies to non soil experiments where the material under study "curls" as it dries. The model 1000 is a pressure / membrane type extractor. It is designed to contain shrink-swell soils during extraction. A special EDPM rubber “hold down” diaphragm is inflated, with 4lbs (1.81Kg) of force holding the soil in hydraulic contact with the cellulose membrane surface. The cellulose membrane material is a pure cellulose and has a pore size of 24 angstrom. The cellulose membrane can withstand over 10,000 kPa bubbling pressure. The standard model 1000 (1002G1) can test up to 12, 2” diameter x 0.39 “ (2.5 x 1 cm) high samples and operates in the 0 to 1500 kPa (0 to 15 bar) soil suction. Choose an optional PM cylinder height, to handle undisturbed cores up to 3 inch high.

SPECIFICATIONS
1000 15 Bar Membrane Extractor 18” L X 18” W X 14” H (45.72 cm X 45.72 cm X 35.56 cm),
Weight: 72 lbs. (32.66 kgs)

ACCESSORIES:

1002G1	Standard 5/8” (1.58 cm) cylinder,	weight 2.8 lbs (1.3 kgs)
1002G2	Tall 1-1/4” (3.2 cm) cylinder,	weight 6.7 lbs (3.0 kgs)
1002G3	Extra tall 1-7/8” (4.75 cm) cylinder,	weight 10.7 lbs (4.8 kgs)
1002G4	Super tall 3-1/2” (8.8 cm) cylinder,	weight 19.8 lbs (9.0 kgs)

1020 PRESSURE MEMBRANE EXTRACTOR 100 BAR

Water retention curves for extremely dry conditions – 100 Bar

In desert research projects where dry soils are the norm, the 100 bar pressure membrane extractor is a valuable instrument. The Model 1020 is also useful in specialized extractions of porous media, including rock cores and mineral cores where hydraulic characteristics of liquids like oil or other types of liquids are to be extracted from fine pore structures. The Pressure Membrane Extractor uses a cellulose membrane supported on a screen drain plate. The cylinder is 2” (5 cm) high, with an inside diameter of 10” (25 cm). The Model 1020 consists of heavy duty; heat treated steel top and bottom plates, a cylinder and 16 hardened steel connecting bolts and seals, a pressure relief valve and a side exhaust valve, which makes it a safe instrument to operate. A high-pressure hose and special high pressure manifold with regulator for connecting the extractor to a pressure source must be ordered separately. Cellulose membranes, soil sample retaining rings and an electrical lead-through are additional accessories that make the extractor complete for operation.

SPECIFICATIONS
1020 100 bar Pressure Membrane extractor: 18” L X 17” W X 14” H (45.72 cm X 43.18 cm X 35.56 cm)
Weight: 146.00 lbs. (66.22 kgs)

ACCESSORIES:

1041D12	Cut cellulose membrane discs, one dozen	0.21 lbs (0.10 kgs)
3030L60	Flexible high pressure hose, 5-ft., JIC type	0.56 lbs (0.25 kgs)
1093	Soil sample retaining rings, one dozen	0.15 lbs (0.06 kgs)
1066	High pressure electrical lead through	0.22 lbs (0.10 kgs)
0750G4	Manifold (high pressure regulator)	5.00 lbs (2.26 kgs)

SOILMOISTURE

HOSKIN SCIENTIFIC

Pressure Plate Extractors

1500F1 PRESSURE PLATE EXTRACTOR 15 BAR

The world standard for obtaining water retention curves, and solution extraction

Water relationships are among the most important physical phenomena that affects agricultural production or structural characteristics of soils. The Model 1500 is used in laboratory study of these many physical relationships, as well as the extraction of soil solution for chemical analysis. For over 60 years universities, colleges, research institutes, and commercial labs around the world continue to rely on Soilmoisture's pressure plate extractors to meet their needs. The extended height of the new Model 1500F1 now allows for 4 pressure plate cells increasing capacity by 25%. The model 1500F1 – 15 bar (1500 kPa) Pressure Plate Extractor is the flagship of moisture retention analysis in the 0 to 15 bar range (theoretical wilting point for most plants). Designed to hold up to 48 – 0.4" (1 cm) height samples, 24 – 1.2" (3 cm) height core samples or 12 – 2.4" (6 cm) height cores. Choose plate cells from 0.5 bar, 1.0 bar, 1.0 bar High Flow, 3.0, 5.0 and 15 bars to suit your needs. You'll need to have a pressure manifold available, or select from our various models in the Air Distribution & System Manifold section of the catalog -of course you'll also need a compressor or compressed air tank as well.

SPECIFICATIONS:
1500F1 15 BAR PRESSURE PLATE EXTRACTOR ONLY
18" L X 17" W X 14" H (45.72 cm X 43.18 cm X 35.56 cm),Weight:94 lbs (43 kgs)

ACCESSORIES:
0675 PRESSURE PLATE CELLS, choose from a wide selection for your unit. (See porous ceramic section)
1093 RETAINING RINGS, 9" L X 9" W X 1" H (22.8 cm X 22.8 cm X 2.5 cm), Weight:94 lbs (43 kgs)
1080G1 PM HINGE, 9" L X 5" W X 5" H (22.8 cm X 12.7 cm X 12.7 cm), Weight:5.38 lbs (2.44 kgs)
1065 ELECTRICAL LEADTHRU 9" L X 5" W X 5" H (7.6 cm X 7.6 cm X 5 cm) ,Weight:0.08lbs (0.04 kgs)

1600 PRESSURE PLATE EXTRACTOR 5 BAR

The standard in obtaining water retention curves, solution extraction in the 0-5 Bar range

For many, their interests are concerned in the optimum plant growth range of 0-5 Bar soil suction range. For engineers it's the wet zone where soil behavior becomes unstable. The 1600 Pressure Plate Extractor is the choice of all worldwide when there's a need for careful and precise measurement of water retention, prepping for stability tests or pore water extraction. This versatile Pressure Extractor also finds application in the calibration of various moisture-measuring equipment assuring that the readings match reality of soil moisture by volume or soil water tension. Easy to clean the epoxy coated interior and exterior complete with safety relief valve. The Model 1600 Pressure Plate Extractor allows analysis of the water-holding characteristics of soil samples in the 0 to 5 bar pressure range. The pressure vessel is 9" (22 cm) deep and has an inside diameter of 12" (30 cm). Up to 4 ceramic plates can be accommodated at one time, allowing approximately 48 each 2-1/4" (5.7 cm) diameter samples to be analyzed simultaneously. Requires a regulated pressure source for operation (see our Air Distribution and System Manifold of the catalog) and a compressor or compressed air tank.

SPECIFICATIONS:
1600 5 BAR PRESSURE PLATE EXTRACTOR ONLY
16" L X 16" W X 16" H (40.64 cm X 40.64 cm X 40.64 cm), Weight:46 lbs (21 kgs)

ACCESSORIES:
0675 PRESSURE PLATE CELLS, choose from a wide selection for your unit. (See porous ceramic section)
1093 RETAINING RINGS, 9" L X 9" W X 1" H (22.8 cm X 22.8 cm X 2.5 cm), Weight:94 lbs (43 kgs)
1080G1 PM HINGE, 9" L X 5" W X 5" H (22.8 cm X 12.7 cm X 12.7 cm), Weight:5.38 lbs (2.44 kgs)
1065 ELECTRICAL LEAD THRU 9" L X 5" W X 5" H (7.6 cm X 7.6 cm X 5 cm) ,Weight:0.08lbs (0.04 kgs)

SOILMOISTURE

HOSKIN SCIENTIFIC

SOIL WATER SAMPLING

1900L SOIL WATER SAMPLER

For near-surface, environmental, ground water, crop health - pore water sampling

The Model 1900 Soil Water Sampler has been a standard for over 30 years in near surface environmental, ground water and plant rooting health where soil pore water is required. It's a large-volume sampler designed for near-surface installation at depths ranging from 6 inches (15 cm) to 6 feet (1.8 m). Most commonly used to collect pore water in near surface profiles, for the analysis of nutrients, pollutants, or other dissolved ions that have an effect on ground waters, environment and crop health.. The unit consists of a 1.9" (4.8 cm) outside diameter PVC tube, with a 2 bar (200-kPa) porous cup, Santoprene stopper, and Neoprene access tube used for evacuation. Clamping rings slip over the folded Neoprene tubing to seal the sampler after evacuation. We recommend an extraction kit, model 1900K2 (50ml) or 1900K3 (1liter) required for sample retrieval and you'll need a vacuum pump required to evacuate the sampler.

SPECIFICATIONS:

1900L06-B02M2 soil water sampler, 6" Length (15.24cm), 0.45 lbs. (0.20 kgs) -	250 ml
1900L12-B02M2 soil water sampler, 12" Length (30.84cm), 0.59 lbs. (0.27 kgs) -	500 ml
1900L24-B02M2 soil water sampler, 24" Length (60.96cm), 0.85 lbs. (0.38 kgs) -	1000 ml
1900L36-B02M2 soil water sampler, 36" Length (91.44cm), 1.07 lbs. (0.48 kgs) -	>1000 ml
1900L48-B02M2 soil water sampler, 48" Length (121.92cm), 1.33 lbs. (0.60 kgs) -	>1000 ml
1900L60-B02M2 soil water sampler, 60" Length (152.4cm), 1.54 lbs. (0.70 kgs) -	>1000 ml
1900L72-B02M2 soil water sampler, 72" Length (182.88cm), 2.02 lbs. (0.92 kgs)-	>1000 ml

1905L & 1911 (SMALL) SOIL WATER SAMPLERS

For container or restricted access pore water sampling

The model 1905L "Slim Tube" soil water sampler is a small 7/8" (2.2cm) diameter sampler designed for taking discrete samples where installation space is limited. The slim tube sampler comes complete with a 1 bar (100 kPa) high-flow, screw in porous ceramic cup, screw on cap. The perfect sampler for container sampling. Extension tubes can be added to increase the depth of operation.

If you need to sample in a cored soil sample or block, or deep in a pit sidewall you will want to consider the 1911 sampler as it can go almost anywhere and at any angle or position to get a pore water sample. The model 1911 Remote Sampler "Only" is configured more for remote sampling using a selection of top fittings for either 1/8" (.317 cm) or 1/4" (.635 cm) diameter. The 1911L10 (4 or 8) comes complete with 10 ft. (3 m) of either 1/8" (317 cm) or 1/4" (.635 cm) tubing making attachment a snap. The vacuum reservoir / collection vessel (purchased separately) is normally situated at a site adjacent to the sampling site. You'll want to consider our model 1900K2 (50ml) or 1900K3 (1liter) extraction kits to address this need.

SPECIFICATIONS:

1905L06 SLIM TUBE SOIL WATER SAMPLER, 6" LENGTH (15 cm)	0.30 lbs. (0.13 kgs)
1905L12 SLIM TUBE SOIL WATER SAMPLER, 12" LENGTH (30 cm)	0.44 lbs. (0.19 kgs)
1905L24 SLIM TUBE SOIL WATER SAMPLER, 24" LENGTH (60 cm)	0.70 lbs. (0.31 kgs)
1905L60 SLIM TUBE SOIL WATER SAMPLER, 60" LENGTH (150 cm)	1.50 lbs. (0.68 kgs)

1911	REMOTE SAMPLER, 3" (7.62 cm) SAMPLE HEAD, ONLY
1911L108	REMOTE SAMPLER, 3" (7.62 cm) SAMPLE HEAD, 10 ft. (3.04 m) -1/8 in (.317 cm) dia. Tubing
1911L104	REMOTE SAMPLER, 3" (7.62 cm) SAMPLE HEAD, 10 ft. (3.04 m) -1/4 in (.635 cm) dia. Tubing

SOILMOISTURE

HOSKIN SCIENTIFIC

SOIL WATER SAMPLING

1920 PRESSURE/VACUUM SOIL WATER SAMPLER

The standard used around the world for PPM pore water sampling

Our best selling pore liquid sampler. Used by regulatory agencies to protect ground water contamination at landfills, impoundments and land farms. Whether your interests concern environmental safety, monitoring pesticide migration, or solubility of nutrients, you can be assured of a history of quality and care in every sampler, spanning more than 30 years. The model 1920F1L provides excellent performance for pore liquid sampling with parts per million (PPM) sensitivity in the unsaturated (vadose) zone. Designed for remote access sampling, spanning hundreds of feet to the sampler. The standard 1920F1L is composed of a porcelain (2 Bar) ceramic cup, epoxy bonded to a Food Grade PVC body. Pressure / vacuum type sampler, is designed to collect samples under a landfill or at depth. It has a sample line to retrieve sample, and a pressure/vacuum line (to evacuate and purge the sampler). It is typically installed at depths to 50 ft (15 meter) in depth with about 100 ft (30 meter) lateral displacement, or they can be installed to 10 ft (3 meter) depth and up to 500 ft (152 meter) lateral displacement.

SPECIFICATIONS:
All 1920 have an outer diameter of 1.9" (5 cm)
1920F1L06 Nominal length 6" (15 cm), sample volume 75 ml, weight 0.38 lbs. (0.20 kgs)
1920F1L12 Nominal length 12" (30 cm), sample volume 150 ml, weight 0.58 lbs. (0.26kgs)
1920F1L24 Nominal length 24" (61 cm), sample volume 300 ml, weight 0.90 lbs. (0.40 kgs)
1920F1L36 Nominal length 36" (91 cm), sample volume 450 ml, weight 1.50 lbs. (0.68 kgs)

1922 & 1923 "ULTRA PURE" SAMPLERS

Parts per billion, sampling for trace quantities, extreme purity required in sampling

Only a very pure, all ceramic sampler complete with Teflon seals can give you that degree cleanliness. There simply is no better product for finding trace elements in the realm of super sensitive subsurface pore water investigative work. Comprised 1 bar High Flow (B01M3) High Fired Alumina Ceramic, with glazed joints, and interior glazed cup having Teflon seals, Teflon fittings, and stainless steel access tube all designed purity. The ULTRA PURE pore liquid sampler design is that of a pressure / vacuum type sampler. Pore liquid pulled from surrounding soil, captured in the glazed interior of the ceramic. Sample liquids "pushed" out under moderate pressure. The porous alumina ceramic material used throughout is a high flow body ceramic with very low adsorption characteristic and (>1.0 bar, -100 kPa) bubbling pressure.

SPECIFICATIONS:
1922 Outside Diameter 1.9" (4.8 cm), Inside Diameter 1.6" (4.1 cm), Length 10"(25.4 cm)
Weight: 1.00 lbs. (0.45 kgs), sample volume 80 ml
1923 Outside Diameter 4.0" (10.2 cm), Inside Diameter 3.37" (8.6 cm), Length 15" (38.1 cm)
Weight: 4.25 lbs. (1.93 kgs), sample volume 560 ml

Accessory Item:
1922K1 ULTRA CASING CLAMP KIT - Diameter 3 in (7.62 cm) long, 2.25 in (5.71 cm)
Weight 5oz (162 gm)

SOILMOISTURE

HOSKIN SCIENTIFIC

Pore Water Sampler	Description	Image
SIC20	Patented silicon carbide cup High permeability, low sorption with a very low dead volume Interchangeable shaft and cup Limited suitability for heavy metals Suction tube length 1.6 m Bubble point- 0.9 bar Shaft diameter 20 mm, acrylic Silicon carbide cup diameter 20 mm, length 60 mm	
SK20 (formerly the SKP100)	Analytes compatible – Nitrate, chloride, sulphate, calcium, sodium, ammonium, phosphorus. Not suitable for heavy metals Suction tube length 1.6 m Bubble point 1 bar Shaft diameter 20 mm, acrylic Ceramic cup diameter 20 mm, length 60 mm pH range 4 to 9	
SKPE25	Allows for water and solute collection from depths down to 8 meters. Not suitable for heavy metals. Suction tube length 1.6 m Bubble point 1 bar Shaft diameter 25 mm PE Ceramic cup diameter 24mm, length 60 mm pH range 4 to 9	
SPE20	Porous PE-Nylon cup which is made especially for heavy metal applications- or wherever ceramics are not appropriate. Optimized for the collection of herbicides, pesticides and heavy metals. Suction tube length 1.6 m Bubble point 1 bar (the porous PE cover allows water to flow up to 20 kPa) Shaft diameter – 20 mm acrylic PE- nylon cup 20 mm diameter, length 60 mm	

Pore Water Sampler	Description	Image
SIC40	Sampler made of silicon carbide with bubble point 10 kPa. SiC is sintered at 2500°C and is chemically much more passive than ceramic or borosilicate. Patented. Please ask for UMS's suitability survey.	
SG Suction Cup	Pore water sampler with porous borosilicate glass cup. Borosilicate is suitable for phosphate and DOC. Available with a diameter of 20 mm or 25 mm.	
SW071 and SW074 Stainless Steel Soil Water Samplers	All welded 304 stainless steel construction with no glue or plastics. Suitable for organics and most inorganics. Separate upper chamber for sample storage (models SW-070 and SW-070A). One way stainless steel valve prevents back flow from storage chamber to sample chamber (models SW-070 and SW-070A). Strong and durable. Suitable for installation at great depths (models SW-070 and SW-070A). 600 mbar bubbling pressure. Optional battery powered vacuum pump (SW-073)	

Hoskin Scientific Ltd

Gee Passive Capillary Lysimeter

Applications:

• Waste Landfill Sites. Used to identify drainage and monitor efficacy of cover systems.
• Food Processing Waste Sites. Maximizes applications by monitoring water drainage rates and water quality below the root zone.
• Environmental research. Measures percolation and recharge rates.
• Farming operations. Measures and informs irrigation during a cropping season.
• Golf Courses. Used to measure and control excess water applications and fertilizer losses.

Monitor Groundwater Leaching
Use the Drain Gauge to determine the volume of water and chemicals draining from the vadose zone into groundwater.

Identify Contamination
The one and a half meter tall Drain Gauge is buried directly in the ground to measure flow rate in unsaturated soils and collect soil water samples for chemical analysis. Water samples can be collected easily through a surface port to analyze for chemicals, fertilizers, and other contaminants.

Measure Deep Percolation Accurately
One of the challenges with lysimeter measurements is that water tends to flow around receptacles buried in the ground. The drain gauge uses an ingenious duct and wick design to apply a constant tension and keep the flow rate within the gauge equivalent to the flow rate in the surrounding soil.

Made from Non-reactive Materials
The Drain Gauge is constructed from inert materials, so chemicals won't react with the tube, the sensors, or the collection reservoir.

KL2 Leachate Sampler

The leachate bucket can be buried in situ to collect leachate - or can be used as a laboratory soil column and lysimeter. On the bottom of the polyethylene bucket a 0.5 bar high flow ceramic plate is fixed.

Technical Information

Diameter	300 mm
Height	300 mm; 600 mm; 1200 mm
Ceramic plate	0.5 bar high flow
Material	stainless steel
Suction tube connector	6 mm

SPG120 Leachate Sampling Plate

SPG120 leachate sampling plate made of porous borosilicate glass. Suitable for phosphate and DOC.

Technical Information

Diameter	Ø 120 mm
Thickness	9 mm ± 1 mm
Suction tube	Teflon; Ø1/16" x Ø 1/8
Tube length	2 m

Model	Description	Image
Vacuum Hand Pump Model: E-127-2005G2	Easy hand operated vacuum pump for extracting solution samples from Soil Water Samplers using an extraction kit (1900K3). Includes a vacuum dial gauge. Capable of developing vacuums to 800kPa. * Rugged portable design for prolonged use in the field * Field repairable valves and pump pads * Pressures to +50 PSI, vacuums to .8 bars suction * All parts brass, stainless steel or rugged plastics for long service Weight: 1.25 Lbs (.57 kgs)	
Pressure/Vacuum Hand Pump Model: E-127-2006G2	Pressure Vacuum Hand Pump provides vacuums up to 0.9 bar (90 kPa) and pressures up to 75 psi (500 kPa). Includes pump, 0-100 cb recalibrator-style vacuum dial gauge, fittings, and inline filter Weight: 5.50 Lbs (2.49 kgs)	
Electric Pressure Vacuum Pump Model: E-127-2008	Electric Pressure Vacuum Pump is battery-operated combination pump, with 2 batteries for total power of 24 AmpHours. With both pressure (Pressure 0-100 psi; with max.presure setting) and vacuum (0-100 cb) gauges. Electric Pressure/Vacuum Pump comes with 2 each 3-foot long hoses, inline filter, and 110V Battery Charger, encased in a portable Pelikan case. Weight: 9.07 kgs	

VacuPorter vacuum case Model: I-802-VACUPORTER	Light-weight, portable, non regulated vacuum case with internal pump for creating vacuum from 0 to 85 kPa or pressure up to 4 bars. Internal rechargeable battery loaded by supplied mains charging device. Clearly arranged front panel with on-off-switch, 2 quick-action tube couplings for vacuum and pressure, one pressure gauge for each vacuum and pressure and charging plug.	
VS Vacuum System Model: I-802-VS	• Vacuum pump with high accuracy • Two vacuum outputs • Selectable constant or tension controlled vacuum • Status indicated by multicolor LED • Optimised for rechargeable battery supply • One Tensiometer connectable: T8, T4 or T5 • Multiple configuration options • Integrated data logger	
VS-pro Vacuum System Model: I-802-VS-PRO	• Display and keypad for basic status check and configuration • Continuous display of readings and status on the LCD • LCD backlight and multicolor LED • Vacuum pump with high accuracy • Two vacuum outputs • Selectable constant or tension controlled vacuum • Optimised for rechargeable battery supply • One Tensiometer connectable: T8, T4 or T5 • Multiple configuration options • Integrated data logger	

Hoskin Scientific Limited has been supplying testing and monitoring instruments since 1946. Although our range is broad, we focus on three major markets including:

Geotechnical & Materials Testing
Environmental Monitoring
Test & Measurement Instrumentation

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